The Engineer.

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PUBLIC NOTICES.

Heriot-Watt College, Edinburgh

DEPARTMENTS OF MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING.

MECHANICAL ENGINEERING:
PROFESSOR A. R. HORNE, O.B.E., B.Sc., M.I. Mech. E., A.M.I.C.E.
ELECTRICAL ENGINEERING:
PROFESSOR F. G. BAILY, M.A., M.I.E.E.
FULL-TIME DAY DIPLOMA COURSES leading to professional recognition.
CLASSES COMMENCE 12th OCTOBER.
Full particulars from the College.
J. CAMERON SMAIL, O.B.E., Principal.
7175

UNIVERSITY OF LONDON.

King's College.

FACULTY OF ENGINEERING.

CIVIL, MECHANICAL, ELECTRICAL and CHEMICAL ENGINEERING.

COMPLETE COURSES of STUDY, extending over three years, are arranged for the Engineering Degrees of the University of London and for the Diplomas and Certificate of the College.

POST-GRADUATE COURSES in CIVIL, MECHANICAL, ELECTRICAL, and CHEMICAL ENGINEERING are also provided.

HEADS OF DEPARTMENTS:

Professor A. H. JAMESON, M.Sc., M. Inst. C.E., Civil Engineering (Dean).
C. H. LOBBAN, D.Sc., A.M. Inst. C.E., Reader in Civil Engineering.
Professor J. K. CATTERSON-SMITH, M.Eng., M.I.E.E., Electrical Engineering.
F. S. ROBERTSON, M.I.E.E., Senior Lecturer in Electrical Engineering.
Professor G. COOK, D.Sc., M.I. Mech. E., M. Inst. C.E., Mechanical Engineering.
S. J. DAVIES, M.Sc., Ph.D., M.I. Mech. E., Reader in Mechanical Engineering.
H. W. CREMER, M.Sc., F.I.C., M.I. Chem. E., Chemical Engineering.
Professor S. A. F. WHITE, M.A. } Mathematics.
Professor A. E. JOLLIFFE, M.A. }

Considerable extensions have been made in the Engineering Department. These include a large additional drawing-office, lecture room and laboratory for Hydraulics and Strength of Materials in the Civil and Mechanical Departments, and research rooms, including Wireless Telegraphy, in the Electrical Engineering Department. Large additions have been made to the equipment of the Laboratories in the four Departments for purposes of teaching and research.

There is a College Hostel and a large Athletic Ground.

For full information apply to the SECRETARY, King's College, Strand, W.C. 2. 7286

The Royal Technical College, GLASGOW.

DEPARTMENTS OF ENGINEERING.

Mechanics and Mechanical Engineering:—
Professor ALEXANDER L. MELLANBY, D.Sc., M.I. Mech. E.;
Associate Professor WILLIAM KERR, Ph.D., A.R.T.C., M.I. Mech. E.
Electrical Engineering:—
Professor STANLEY PARKER SMITH, D.Sc., M.I.E.E., A.M. Inst. C.E.
Civil Engineering:—
Professor GEORGE MONCUR, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.
Mining Engineering:—
Professor DANIEL BURNS, M. Inst. M.E.
Chemical Engineering:—
Professor of Technical Chemistry: THOMAS GRAY, D.Sc., LL.D., Ph.D., F.I.C.

Complete Courses of instruction are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.

Composition fee, 25 guineas per annum.

SESSION 1931-32 BEGINS on TUESDAY, SEPTEMBER 22nd.

Calendar, by post, 3s., and prospectus, gratis, may be obtained on application to the SECRETARY. 7223

The University of Sheffield.

SESSION 1931-32.

Vice-Chancellor: A. W. PICKARD CAMBRIDGE, M.A., D.Litt.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 7th, 1931.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 29th, 1931.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS, Registrar.
7255

The Manchester Steam Users' ASSOCIATION.

For the Prevention of Steam Boiler Explosions and for the Attainment of Economy in the Application of Steam, 20, QUAY-STREET, DEANSGATE, MANCHESTER.

Founded 1854 by SIR WILLIAM FAIRBAIRN.

Certificates of Safety issued under the Factory and Workshops Act, 1901. Compensation for Damages and Liabilities paid in case of Explosions. Engines and Boilers Inspected during construction. 6762

The Engineer

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University of Bristol.

FACULTY OF ENGINEERING.

(Provided and Maintained in the MERCHANT VENTURERS' TECHNICAL COLLEGE.)

VICE-CHANCELLOR: T. LOVEDAY, M.A., LL.D.
DEAN OF THE FACULTY: ANDREW ROBERTSON, D.Sc., M.I. Mech. E., M. Inst. C.E.

DEPARTMENTS.

CIVIL ENGINEERING—Prof. A. J. SUTTON PIPPARD, M.B.E., D.Sc., M. Inst. C.E., M.I. Mech. E., F.R.Ae.S.
MECHANICAL ENGINEERING—The DEAN.
ELECTRICAL ENGINEERING — Prof. DAVID ROBERTSON, D.Sc., M.I.E.E.
AUTOMOBILE ENGINEERING—Prof. W. MORGAN, B.Sc., M.I.A.E.
MATHEMATICS—Prof. E. S. BOULTON, M.A., B.Sc.
GEOLOGY—Prof. S. H. REYNOLDS, M.A., Sc.D.
CHEMISTRY—Prof. F. FRANCIS, D.Sc., Ph.D., F.I.C.

Full particulars of Courses and of the University Halls of Residence may be obtained on application to the REGISTRAR, M.V.T. College, Bristol.

The SESSION 1931-32 COMMENCES on OCTOBER 2nd. 7226

University of Birmingham.

FACULTY OF SCIENCE.

ENGINEERING DEPARTMENT.

I. MECHANICAL ENGINEERING.

"Chance" Professor: S. LEES, M.A. (Cantab.), A.M.I. Mech. E.

II. CIVIL ENGINEERING.

"Beale" Professor: CYRIL BATHO, M.Sc., D.Sc. (McGill), B.Eng., M. Inst. C.E.

III. ELECTRICAL ENGINEERING.

Professor: WM. CRAMP, D.Sc., M.I.E.E.

The FULL COURSES EXTEND OVER FOUR YEARS and students who enter after Matriculation and pass successfully the necessary examinations will be ENTITLED TO THE DEGREE OF BACHELOR OF SCIENCE IN ENGINEERING.

The NEXT SESSION COMMENCES on OCTOBER 5th, 1931.

For detailed syllabus of the Faculty apply to the REGISTRAR. 7305

PUBLIC NOTICES.

University of Birmingham.

DEPARTMENT OF METALLURGY.

"FEENEY" PROFESSOR, D. HANSON, D.Sc.

The Course of Study covers three years and leads to the Degree of B.Sc. in Metallurgy. There is also an Honours School. Special attention is devoted to Iron and Steel, Copper, Brass, Metallography, the needs of local Industries and to preparation for Colonial and Foreign Posts.

The NEXT SESSION COMMENCES on OCTOBER 5th, 1931.

Research and other Scholarships.

For detailed syllabus apply to the REGISTRAR. 7304

The Queen's University of BELFAST.

VACANCY FOR JUNIOR ASSISTANT IN DEPARTMENT OF CIVIL ENGINEERING.

PARTICULARS.

1. The appointment is for one year, renewable for a period of three years.
2. The duties are chiefly to superintend drawing and design classes, to instruct in surveying class and field work, and to assist generally in the work of the Department under the direction of the Professor.
3. The salary is £250 per annum, for three terms of about 12 weeks each.
4. Candidates must hold a University Degree in Engineering.
5. Facilities will be given for advanced and research work in the Department.
6. Applications and copies of testimonials must be sent to PROFESSOR HUMMEL, Queen's University, Belfast, on or before September 1st, 1931. 7287

University of Bristol.

FACULTY OF ENGINEERING.

The University invites APPLICATIONS for the following POST:—

A LECTURESHIP in CIVIL ENGINEERING (GRADE II.). Salary £400.

Applications should reach the undersigned, from whom further particulars may be obtained, on or before Monday, July 27th.

WINIFRED SHAPLAND, Secretary and Acting Registrar.
7267

PUBLIC NOTICES.

Form P., Amendt. 2.

PATENTS AND DESIGNS ACTS, 1907 TO 1928.

Notice is Hereby Given that

the QUASI-ARC CO., LTD., 15, Grosvenor Gardens, London, S.W. 1, and ARTHUR PERCY STROHMENGER, of the same address, SEEK LEAVE to AMEND the SPECIFICATION of the APPLICATION for LETTERS PATENT No. 346,587 for an invention entitled "Improvements relating to Welding Rods for Use in Electric Arc Welding."

Particulars of the proposed Amendment were set forth in No. 2217 of the Illustrated Official Journal (Patents), published on July 15th, 1931.

Any person, or persons, may give Notice of Opposition to the Amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton buildings, London, W.C. 2, within one calendar month from the date of publication of the said Journal.

W. S. JARRATT, Comptroller-General.
P1339

City of Nottingham.

WATER DEPARTMENT.

ELECTRICALLY DRIVEN MULTI-STAGE BOOSTER PUMPS AT SELSTON AND NORMANTON-ON-THE-WOLDS, NOTTS.

The Water Committee invite TENDERS for the SUPPLY and ERECTION of PUMPING PLANT, consisting of Electrically Driven Multi-stage Centrifugal Booster Pumps, Electric Motors, and other appurtenant Work, in the Parishes of Selston and Normanton-on-the-Wolds, Notts.

Copies of the general conditions of contract, specifications, schedules, bills of quantities and forms of Tender may be obtained on application to Mr. F. W. Davies, Engineer and General Manager, Water Department, Castle Boulevard, Nottingham. Applications for each scheme must be accompanied by a cheque for Three Guineas, which will be refunded on receipt of bona fide Tenders and the return of all documents.

Sealed Tenders, in separate envelopes endorsed "Tender for Booster Pumps, Selston," and "Tender for Booster Pumps, Normanton-on-the-Wolds," must be delivered to me at my office not later than 17th August, 1931.

By Order,
W. J. BOARD, Town Clerk.
Guildhall, Nottingham, 20th July, 1931. 7282

County of London.

The London County Council invites TENDERS for the SUPPLY and INSTALLATION at the Greenwich Power Station of:—

(A) HIGH-PRESSURE STEAM and CIRCULATING WATER PIPES, DE-SUPERHEATING PLANT, &c.
(B) ELECTRICALLY DRIVEN CIRCULATING WATER PUMPS, STRAINERS, &c.

The specification, drawings, form of Tender, &c., may be obtained from the General Manager of Tramways, Tramway Offices, 23, Belvedere-road, S.E. 1, upon payment of £2. This amount will be repayable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before the payment of the fee.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council, The County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 24th August, 1931, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX, Clerk of the London County Council.
7305

The County of London Electric SUPPLY CO., LTD.

BARKING POWER STATION EXTENSIONS, 1930
TENDER FOR THE SUPPLY OF TRANSFORMERS

The County of London Electric Supply Company, Limited, are prepared to receive TENDERS for the SUPPLY and ERECTION of TRANSFORMERS in connection with the Extensions to the Power Station at Barking.

Specifications may be obtained by manufacturers of Transforming Plant from the offices of the Company by application on or after Monday, 27th July, 1931, and on payment of a fee of £5 5s. for the first copy and £2 2s. for every subsequent copy. Sums paid for any number of copies up to three will be refunded on receipt of a bona fide Tender.

Sealed Tenders, endorsed "Tender for Transformers," must be delivered, addressed to the CHAIRMAN and MANAGING DIRECTOR, The County of London Electric Supply Co., Ltd., County House, 46/47, New Broad-street, London, E.C. 2, not later than Noon on Monday, 24th August, 1931.

The Company do not bind themselves to accept the lowest or any Tender. 7306

Northern Polytechnic, HOLLOWAY, LONDON, N. 6.

The Governors invite TENDERS for the SUPPLY and ERECTION of a SELF-CONTAINED BOILER, to raise 3000 lb. steam per hour at 150 lb. pressure. 7291

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PUBLIC NOTICES.

TO ENGINEERING CONTRACTORS.

Newry Port and Harbour Trust.

NEWRY SHIP CANAL—IMPROVEMENT SCHEME.

The Joint Committee of Newry Urban District Council and Newry Port and Harbour Trust is prepared to receive separate TENDERS for the EXECUTION of the following CONTRACT WORKS, viz.:—

CONTRACT WORK No. 1.—Breastwork of Timber Sheet Piling to Toe of Outer Embankment.
CONTRACT WORK No. 2.—Rubble Toe, Filling and Pitched Slopes on River Side of Outer Embankment.
CONTRACT WORK No. 4.—Widening and Deepening of Newry Ship Canal (approximately 84,000 cubic yards).
CONTRACT WORK No. 6.—New Wharf and Strengthening of Quay Wall on West Side of Albert Basin (Steel and Timber Piling, &c.).
CONTRACT WORK No. 7.—General Repairs to Pitching on East and West Banks of Newry Ship Canal.

The contract drawings and specification have been prepared by Messrs. R. Ferguson and S. McIlveen, Consulting Engineers, 36, Scottish Provident Buildings, Belfast, and may be inspected at their offices by arrangement.

A copy of the contract documents comprising form of Tender, form of agreement, conditions of contract, specification, bills of quantities and schedule of prices for each of these works may be obtained from the undersigned on payment of a sum of Five Guineas, which will be returned on receipt of a bona fide Tender. No Tender shall be retracted or withdrawn during three calendar months from date on which it is received.

The Tenders (which should be sealed and endorsed "Tender for Newry Ship Canal—Contract Work No. ....), will be received by the undersigned up to Twelve o'clock Noon on Monday, the 31st day of August, 1931.

The acceptance of a Tender will be subject to the approval of the Ministries of Finance and Commerce for Northern Ireland.

The lowest or any of the Tenders may not necessarily be accepted. Firms tendering must be responsible for all expenses incurred incidental to the preparation of their Tenders.

W. M. CRONIN (Town Clerk),
Hon. Sec. to the Joint Committee.

Town Clerk's Offices,
Town Hall, Newry,
24th July, 1931. 7298

The Chinese Government Purchasing Commission.

The Commission is prepared to receive TENDERS from British Manufacturers for :—

(A) H.S. and COVERED 40-TON ALL-STEEL BOGIE WAGONS.
(B) 45 m. Span BRIDGE.
(C) 100ft. Span BRIDGES.
(D) FREQUENCY CHANGER.

Tender forms, &c., can be obtained at the offices of the Consulting Engineers :—

Messrs. FOX and MAYO,
155, Dashwood House, Old Broad-street, London, E.C.2,

through the post, on 27th to 29th July, or between 11 a.m. and 1 p.m. on those days.

A fee of £1 for (A), (B) and (C), and 5s. for (D), which is not returnable, will be charged for each Tender form, &c.

7309 BY ORDER OF THE COMMISSION.

The Madras and Southern Mahratta Railway Company, Limited,

invite TENDERS for :—

(1) 3015 HELICAL and 2940 VOLUTE SPRINGS (BROAD and METRE GAUGE).
(2) 120 STEEL AXLES for CARRIAGES and WAGONS (BROAD GAUGE).
(3) 1300 STEEL TYRES for CARRIAGES and WAGONS (BROAD and METRE GAUGE).
(4) 660 STEEL TYRES for LOCOMOTIVES (BROAD and METRE GAUGE).
(5) 8500 STEEL BOILER TUBES and 310 SUPERHEATER FLUE TUBES (BROAD and METRE GAUGE).

Tenders are due in on Tuesday, 11th August, 1931, by 2 p.m. Tender forms obtainable at address below; fee One Guinea each, WHICH IS NOT RETURNABLE.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices :—
25, Buckingham Palace-road,
Westminster, S.W. 1. 7295

Urban District Council of Athlone.

ELECTRIC MOTORS AND CENTRIFUGAL PUMPS.

The Urban District Council of Athlone invites TENDERS for the SUPPLY, ERECTION, and MAINTENANCE for twelve months of THREE CENTRIFUGAL WATER PUMPS with ELECTRIC MOTORS and SWITCHGEAR.

Forms of Tender and copies of the conditions of contract and specification and plan may be obtained on application in writing to the Consulting Engineer, Desmond McAteer, A.R.C.Sc.I., M. Inst. C.E.I., 3, Westmoreland-street, Dublin.

Tenders should be sent by registered post and marked "Tender for Electric Pumps," and be addressed to the Clerk of the Urban District Council of Athlone, and should reach him not later than Five o'clock p.m. on the 2nd September, 1931.

The Council does not bind itself to accept the lowest or any Tender.

By Order of the Council,
P. V. C. MURTAGH,
Clerk.

Urban District Council Office, Athlone,
16th July, 1931. 7290

County Borough of Swansea.

SEWERAGE AND DRAINAGE DEPARTMENT.

MAIN DRAINAGE SCHEME, CONSTRUCTION OF MAIN TRUNK SEWER, SEA OUTFALLS AND STORAGE TANKS, &c.

APPOINTMENT OF RESIDENT ENGINEERS AND CLERKS OF WORKS.

The Council invite APPLICATIONS for the following TEMPORARY APPOINTMENTS :—

(A) SENIOR RESIDENT ENGINEER : salary at the rate of £700 per annum.
(B) ASSISTANT RESIDENT ENGINEER ; salary at the rate of £500 per annum.
(C) THREE CLERKS of WORKS ; salary at the rate of £7 per week each.

The duration of the works will be for a probable period of three years, and the above appointments will be determinable by one month's notice on either side.

Applicants for the appointments under (A) and (B) must have undergone a regular course of engineering training and be thoroughly experienced in the duties of Resident Engineer, as applied to Sewerage Works of considerable magnitude carried out under contract.

Applicants for the appointments under (C) must be thoroughly trained Clerks of Works, experienced in Sewerage Works, involving large-sized Brick and Concrete and Cast Iron Constructions.

It is essential that applicants for all the above appointments shall have had considerable previous experience in important Main Drainage Works, involving Sea Outfalls and large Tunnelling Operations.

Applications must be made on forms to be obtained from Mr. J. Richard Heath, Chief Engineer, Main Drainage Scheme, Guildhall, Swansea, to whom applications shall be addressed, endorsed "Resident Engineer," or "Clerk of Works," as the case may be, and be received not later than the first post on the 18th August, 1931.

H. L. LANG-COATH,
Town Clerk.

Guildhall, Swansea,
20th July, 1931. 7297

MICHELL BEARINGS, Ltd.,
ENGINEERS & MANUFACTURERS OF
Michell Thrust & Journal Bearings
Registered Office and Works:
South Benwell Newcastle-on-Tyne.

VALUATIONS
AND
FIRE INSURANCE

To be **Over-Insured** is folly. This means you pay a Heavy Premium for the Recovery of Assets in Excess of their worth which, in the event of fire, **would be Disallowed.**

* * * * *

To be **Under-Insured** is equally prejudicial to your interests, for, if a fire took place, you would only recover a proportion of your loss.

* * * * *

The only Remedy is a **"Valued Policy,"** which means that the contents of the Policy have a **Guaranteed Value** as a claim **without Assessing.**

* * * * *

If insurers realised the enormous advantages of "Valued Policies," few, indeed, would hesitate to adopt them.

* * * * *

The usual Policy is nothing more nor less than a pure **Estimate** for the purpose of fixing Premiums which, in most cases, are based upon fictitious grounds, usually ending in disillusionment for the insured.

* * * * *

When a Policy is bought, honest **Proof of Loss,** up to the Policy amount, should be paid to the last sixpence, and **this can be Definitely Secured,** provided the insurer is furnished with an Inventory of his Insured Assets which is produced and forms the basis of the **Contract** between himself and the Insurance Company.

* * * * *

Insurance Companies do not assess the Value of your assets **Before the Fire,** but accept your estimate upon which the Premium is based, and should you suffer loss by fire, their assessors then endeavour to assess the loss **After the Assets have been Wholly or Partially Destroyed!**
Could anything be more fatuous?

* * * * *

A **"Valued Policy"** is a **Contract,** usually lasting for twelve months, **Definitely Guaranteeing** that "in the event of fire an amount not exceeding, but **Up to the Amount Insured, will be Paid** for the Destruction of items insured."

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If you are not so protected, permit us to advise and assist you.

WHEATLEY KIRK, PRICE & Co.

(ESTB. 1850)
SPECIALISTS IN
VALUATIONS OF ENGINEERING AND MANUFACTURING WORKS AND PLANT.
(Valuers for the Assured only.)

46, WATLING STREET, LONDON, E.C. 4.

FACTORIES WANTED.

LEADING CONTINENTAL MANUFACTURER
with considerable goodwill in this country
WISHES TO PURCHASE MODERN WORKS
of moderate size, but capable of extension,
OR ACQUIRE INTEREST IN GOING BRITISH CONCERN
with up-to-date equipment
FOR PRODUCING TURBINE PUMPS
and other High-class Specialities.

Full particulars to Box No. 7280, "The Engineer," 28, Essex-street, Strand, W.C. 2.

PUBLIC NOTICES

Abergele and Pensarn Urban District Council.

ABERGELE AND PENSARN SEWERAGE.
APPOINTMENT OF CLERK OF WORKS.

The Council REQUIRE the SERVICES of an ENGINEER, to act as CLERK OF WORKS, in connection with the Construction of about 370 Yards of 21in. diameter Cast Iron Pipe Sea Outfall Sewer and about 1200 Yards of 30in. to 9in. diameter Concrete Tube or Stoneware Pipe Sewers, together with Rising Main, Pumping Station, and the Incidental Works in connection therewith.

Applicants must be fully qualified by actual experience in similar work, and must be competent in the use of the level and theodolite and able to set out, test and measure up the works and check accounts.

The salary will be at the rate of £364 per annum, and, subject to satisfactory service, the appointment will be for the period of the construction of the works, which, it is estimated, will occupy at least nine months.

The person appointed will be required to act under the instructions of the Council's Consulting Engineer, Mr. Robert Green, M. Inst. C.E., 37, Bennett's-hill, Birmingham, from whom applicants can obtain a copy of the prescribed form of application, which must be filled in and delivered to me not later than the 3rd August, 1931.

JOHN R. WILLIAMS,
Solicitor and Clerk to the Council.

Town Hall, Abergele, North Wales,
16th July, 1931. 7294

SITUATIONS OPEN.

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

TO ADVERTISERS UNDER BOX NUMBERS IN THIS CLASSIFICATION.

For the benefit of applicants, the Proprietors are prepared to insert brief notices that vacancies are filled, upon receipt of notifications from the Advertisers. These notices (limited to one line) will be free of charge and co-operation is asked for.

WANTED, a NUMBER of RATE FIXERS for an Engineering Establishment in Broadheath (Manchester district).
Fitting experience a recommendation.
Address, giving particulars of experience, age and salary required, P1340, The Engineer Office. P1340 A

WANTED, by Engineering Firm, Energetic YOUNG GENTLEMAN, with good knowledge of London buyers of Structural Steelwork, &c. Must be good canvasser.—Address, stating qualifications, age and salary expected, 7310, The Engineer Office. 7310 A

BRUSHES.—WANTED, WORKS MANAGER for old-established Factory. Must be man of tact and initiative, experienced in the trade and capable of getting his own way.—Particulars and commencing salary in strict confidence to Box ZR 800, c/o Deacon's Advertising Offices, Fenchurch-avenue, E.C. 3. 7308 A

CONSTRUCTIONAL STEEL WORKS in London REQUIRE MANAGER, fully qualified with proved capacity for Salesmanship. Large scope and good salary for right man. Replies must give full particulars of experience, which will be treated in strict confidence.—Write, Box C.S. 543, care Deacon's, Fenchurch-avenue, London, E.C. 3. 7307 A

CRANE ENGINEER for New Works in the Midlands, with first-class designing experience combined with outstanding business ability.

Must be able to control a large staff and produce structural and mechanical designs so economical—yet thoroughly reliable—as to secure orders against the strongest competition.

Good theoretical knowledge, not necessarily high mathematical attainments, which has been thoroughly tried out in practice, essential.

To the right man a substantial salary will be paid.

Give full particulars of experience, which will be treated in strict confidence, and state age, which should be about 40, salary expected, and when at liberty.
Address, 7319, The Engineer Office. 7319 A

PROMINENT FIRM of Metal Plate Workers REQUIRE OUTSIDE TECHNICAL REPRESENTATIVE.
Must be well acquainted with requirements of Chemical Trade and have had considerable Works experience, with knowledge of various Metals and Alloys and their Uses and Limitations. Drive own car.—Address, giving full particulars of education, age, experience, &c., and state salary required, P1344, The Engineer Office. P1344 A

REPRESENTATIVE REQUIRED by Reputable Firm of Merchants for Southern Counties. Used to Machine Tools and General Plant.—Address, giving details of experience, if any, 7289, The Engineer Office. 7289 A

THE APPOINTMENT of a First-class STEEL and HEAT-TREATMENT EXPERT in a Steel Foundry in the Midlands is BEING CONSIDERED.
Experience of Acid and Basic Open Hearth Furnaces and of Tropenas Process essential.
State age, salary expected, and previous experience.
Applications, which will be treated with confidence, should be addressed to :
7278, The Engineer Office. 7278 A

WELDING INSTRUCTOR WANTED for Factory in London district. Must have first-class technical and personal practical experience of Electric Bare Wire Welding. Man with good metallurgical training essential. Gas welding experience an asset.
Address, stating age, experience and salary required, 7317, The Engineer Office. 7317 A

WORKS SUPERINTENDENT WANTED for Shop employing about 500. Must have had considerable experience in the Manufacture of A.C. and D.C. Motors and Control Gear, and have held similar position with good firm in the same line of business for at least five years.
Good disciplinarian, and for one who is capable of bringing ideas forward this is an excellent opportunity.
Address, giving qualifications and salary required :
7302, The Engineer Office. 7302 A

For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Mr. J. M. Ormston's Appointment.

THE announcement is made by Vickers-Armstrongs, Ltd., that Mr. J. M. Ormston, shipyard manager of the Naval Yard, Walker-on-Tyne, has been appointed a special director of the company. He will be in full charge of the Naval Yard, and will be directly responsible to Commander C. W. Craven, the managing director of the works and shipyard of Vickers-Armstrongs, Ltd. Mr. Ormston, who was born on October 5th, 1885, became, on the completion of his education, an apprentice engineer at the Elswick shipyard of Sir W. G. Armstrong, Whitworth and Co., and then spent three years at the Royal Naval College at Greenwich. On his return to Armstrong's, he was made assistant shipyard manager and supervised the construction of large naval vessels. After a short time he went to Scott's Shipbuilding and Engineering Company, Ltd., at Greenock, where he spent two further years in a similar capacity. In 1913 he joined the late Sir George Carter at Cammell Laird and Co.'s Birkenhead yard, where for a period of seven and a-half years he had charge of the shipbuilding and repair work. During his stay at Birkenhead he was an active member of the Works and Conference Board of the Shipbuilding Employers' Federation and took an important part in the settlement of differences and disputes which arose at that time. After the war Mr. Ormston was appointed to take full charge of the shipyard. In December, 1925, however, he took up a position as assistant to the general dockyard manager of the Singapore Dock, and on his return to this country joined Vickers-Armstrongs, Ltd. It will be recalled that early in the year Mr. Ormston was sent from Barrow-in-Furness to Walker in order to take charge of the shipyard work when the order for the electrically propelled liner "Monarch of Bermuda" was received from Furness, Withy and Co., Ltd. This liner was launched on March 17th and was referred to in a Journal note published in our issue of March 20th.

Turbo-Electric Liner.

ON Saturday of last week, July 18th, the second of the two turbo-electrically propelled liners which are being built by Vickers-Armstrongs, Ltd., for the P. and O. Australian service, was launched from the Naval Yard at Barrow-in-Furness. The new liner was named the "Strathaird," and, like her sister, the "Strathnaver," which is now being fitted out, she has an overall length of 664ft., with a beam of 80ft. and a measurement of 22,000 gross tons. Her propelling machinery, which has been supplied by the British Thomson-Houston Company, Ltd., of Rugby, comprises two separate turbo-alternators, each with its own condensing plant and auxiliaries. The alternators supply current to two slow-speed synchronous motors, which are coupled direct to the twin propeller shafts. All contactor gear and control levers are arranged on the control platform. Each alternator has a maximum rating of 10,700 kW at 3000 r.p.m. and delivers 3000-volt three-phase current to a 14,000 S.H.P., 125 r.p.m. propulsion motor. The total power of 28,000 S.H.P. is sufficient for a service speed of 22 knots, the measured mile trial speed being about 26 knots. The two main condensers are of the latest Weir regenerative type, each having a surface of 32,000 square feet, the air pump equipment being designed to maintain a vacuum of 28in. with a sea temperature of 82 deg. Fah. Steam will be raised in four Yarrow boilers of the five-drum double-flow side-fired type at a pressure of 400 lb. per square inch with a superheated steam temperature of 725 deg. Fah. Two auxiliary boilers of the same type and design are also provided, while the auxiliary turbo-generator sets include three 750-kW units and one 400-kW unit. Both ships are expected to be delivered to the owners before the end of the present year.

Large Order for Electric Plant.

OUR readers are aware that the South African Iron and Steel Industrial Corporation is, with the support of the Union Government, erecting extensive iron and steel works in the Pretoria district. We now learn that Dorman, Long and Co., Ltd., who are the main contractors for the steel works and rolling mills, have just instructed the English Electric Company, Ltd., to proceed with the whole of the electrical equipment. The order covers the supply of electric motors totalling some 86,000 H.P., with transformers, switchgear and cabling. The main power supply will be taken to an Ilgner sub-station at 11,500 volts and will be transformed down to 3300 volts. This sub-station will contain a fourteen-panel 11,500-volt switchboard, two 5000-kVA transformers to feed the mill equipment, two 2000-kVA transformers and two 1250-kW rotary converter equipments, &c. A second sub-station, fed from this centre, will contain two 2000-kVA transformers, two 1250-kW rotary converter equipments and auxiliary plant. The main rolling mill drives will be of considerable interest in virtue of the large size of the motors. For the blooming and rail mills there is to be a single-armature motor, which will have a cut-out turning moment of 160 metre-tons at any speed from 0/80 r.p.m., corresponding to 18,000 B.H.P. This reversing motor will be supplied from a fly-wheel motor generator set having a driving motor of 4200 H.P., a 33-ton fly-wheel and three D.C. generators, which will be connected in series to supply the mill motor at 1290 volts. The mill motor will be the largest single-armature machine, and the Ilgner set the most powerful yet built by the English Electric Company. For the continuous merchant, bar and rod mill there will be a non-reversing continuous roughing mill motor of 1500 H.P. with a speed range of 300/600 r.p.m., a double-armature non-reversing finishing mill motor of 1800 H.P., 500/850 r.p.m., and five small finishing mill motors of 150 H.P., two having a speed range of 500/1000 r.p.m. and three a speed range of 700/1400 r.p.m. All these machines will be started simultaneously by Ward-Leonard control on the generators of a motor generator set driven by a synchronous motor of 4750 H.P., designed for a leading power factor of 0·88.

The Shipment of Complete Locomotives.

THE announcement was made by Mr. E. G. Brownhill, chairman of the Traffic Committee, at the weekly meeting of the Mersey Docks and Harbour Board last week, that, by improving the railway access to the Langton Branch Dock, the shipment of complete locomotives and railway coaches had been facilitated. The necessary improvements had been carried out in response to present-day demands, that locomotives and other rolling stock, &c., should be shipped complete rather than in parts. Mr. Brownhill said that the work had been carried out by the co-operation of the Mersey Docks and Harbour Board, the London, Midland and Scottish Railway Company, and the Bootle Corporation, and that it consisted of a new direct rail connection between the Alexandra Dock station of the railway company to the East Quay of the Langton Dock. The railway lines had been rearranged at the dock in such a way that the time necessarily absorbed by the cranes in making their lifts had been considerably reduced. At the same time ample storage and shunting accommodation for loaded and empty wagons was provided. As a result of these arrangements, it would be possible for out-of-gauge railway traffic to be conveyed by rail to the East Quay of Langton Dock for shipment in any dock either at Liverpool or Birkenhead by means of one of the floating cranes belonging to the Board.

A Director of Airship Development.

THE Air Ministry now announces that as from July 1st the Directorate of Airship Construction was transferred from Cardington to the Air Ministry. Group Captain W. C. Hicks has been appointed Director of Airship Construction, with effect from the above-mentioned date. He will be responsible under the Air Member of Council for Supply and Research for all airship matters, including development, experiment, and research, the last-named work being carried out in co-operation with the Director of Scientific Research. The Director of Airship Construction will also be responsible for the administration of the Royal Airship Works at Cardington and other airship bases, and for the development of kite balloons. The Cardington works will become an out-station establishment controlled by a superintendent coming directly under the Director of Airship Construction, and Squadron-Leader S. Nixon has been appointed to fill that office. Dr. H. R. Cox, B.Sc., Ph.D., A.F.R.Ae.S., has been appointed to be Chief Technical Officer at Cardington, while the Officer-in-Charge of Flying and Flying Training at the Royal Airship Works, Cardington, will be Squadron-Leader R. S. Booth, the captain of "R 100."

Charing Cross Bridge.

ON July 10th we noted, on this page, that the London County Council had decided to reconstitute the Charing Cross Bridge Advisory Committee in order that it might re-examine the proposals included in scheme No. 4. The Improvements Committee placed the report of the Advisory Committee before the Council last Tuesday. The latter Committee holds that the cost of scheme No. 4 is in excess of £12,500,000, the pecuniary limit laid down by the Government and that, further and apart from the question of money, the proposals are not such as it could recommend for adoption. It is stated that the plans fail to provide for the purchase of many properties which must be acquired if the scheme is to be carried out, for the road levels in some places are to be raised 22ft., and, in the view of the Committee, properties abutting on such roads would fall under the category of buildings requiring compulsory acquisition. This necessity the authors of scheme No. 4 do not concede, except to a small extent. Some important buildings, such as the headquarters of the London Telephone Service, Messrs. W. H. Smith and Sons' depôt, and the Royal Waterloo Hospital for Women and Children stand in the area affected. There is a saving in first cost, it is estimated, in favour of scheme No. 6 of between £750,000 and £1,000,000, and the Committee believes that scheme No. 4 would finally cost between £2,000,000 and £3,000,000 more than scheme No. 6. The latter scheme is, therefore, re-submitted for adoption. The decision of the Committee has called forth from the authors of scheme No. 4 a letter, which was published last Tuesday in *The Times*. In this letter, the authors reaffirm their opinion that the Committee over-estimates the cost of their proposals, and point out that in their opinion the recoupment to be expected if their scheme was adopted would more than offset the extra cost. They point out, also, that Parliament rejected the proposals submitted to it last year partly owing to the bridging over of roads, and that under scheme No. 6 the area under the railways in road tunnels and covered parking places is about doubled as compared with the first proposals. Under the circumstances, they ask would it not be better for the County Council to proceed with the reconditioning of Waterloo Bridge and to formulate a scheme for Charing Cross Bridge free from the objectionable features to which the Special Committee of the House of Commons took exception. The London County Council has decided to seek Parliamentary powers to proceed with the building of the bridge according to scheme No. 6.

The Scottish Shale Industry.

SPEAKING at Bathgate last Sunday, Mr. Shinwell, the Secretary of Mines, mentioned that the Government had found it impracticable to give any financial assistance to the Scottish shale oil industry. Every avenue out of the difficulty had been explored without success. A direct subsidy could not at present be afforded by the national finances, while any such grant would raise the question of subsidies for other depressed industries. The suggestion that oil refined at Uphall should be exempted from Excise Duty was impracticable, owing to the difficulty of limiting preference to one refinery. He also pointed out that the Admiralty at present purchased fuel oil at 30s. per ton. Shale oil would cost about £6 per ton, and if the Admiralty purchased it there might be an increase of £500,000 per year in the estimates. The shale oil industry has been threatened with extinction for a number of years, and it is not impossible that the Government decision may result in a stoppage of work at a number of mines and the loss of employment by about 2000 men.

A British Works Management Association.

WITH a view to providing a means of bringing into personal contact all individuals engaged in works management, irrespective of their trade and industry, there has just been founded a British Works Management Association, with offices at 68, Victoria-street, Westminster. The Association will provide opportunities for the statement, discussion and elucidation of the non-technological problems which may be encountered in any manufacturing undertaking, and for the general interchange of management experience. Its further object is to assist in increasing the productive efficiency of British industry by developing the technique of management. The membership is open to all those who may be engaged in works and factory management or in such other branches of industrial administration, engineering, or research as may, from time to time, be determined by the Council. All members are to be persons occupying positions of executive authority, while associate members shall be persons who, while otherwise qualified for membership, do not hold such positions. The first President of the Association is Mr. E. J. Fox, the managing director of Stanton Ironworks Company, Ltd., who has pointed out that the future of British industry can only be assured by a general readiness to study the world's new needs and to minister to them with energy and imagination. The sales managers of the country, Mr. Fox recalls, have already shown an encouraging disposition to recognise this fact, and the formation of the British Works Management Association is, he suggests, evidence that those engaged on the production side of industry are equally alive to the challenge. The joint honorary secretaries of the Association are Mr. A. P. Young, B.Sc., and Mr. Clifton Reynolds. The first conference will be held in October next.

The Schneider Trophy.

THE announcement has now been made that some of the members of the Italian team to take part in the Schneider Trophy race will arrive at Calshot on August 12th. This first contingent consists of twelve men, including two officers, and is equipped with three training seaplanes. The remainder of the team, including twelve officers and forty men, is not expected to arrive before August 26th, and by that time or soon afterwards, it is hoped that the new Italian machines will be ready for practice flights. Owing to the greater distance between Calshot and the starting point of the race this year than on the last occasion, the Italians will bring over by sea a number of pontoons for conveying the seaplanes to and fro. In 1929 such pontoons were unnecessary. The French Government has placed orders for the construction of such pontoons in this country. Although it is known that both France and Italy have found considerable difficulty in producing new engines for this year's race, little doubt is felt that the two countries will compete. No information has yet been received as to the date on which the French team will make an appearance at Calshot.

The Royal Agricultural Show at Warwick.

No. IV. (*Conclusion*).*

JOHN FOWLER AND CO.

A NEW high-speed compression ignition engine made its appearance on the stand of the makers, John Fowler and Co. (Leeds), Ltd. It is of the six-cylinder vertical type—see Fig. 25—with a bore and stroke of 120 mm. by 180 mm. and gives 90 brake horse-power at 1500 revolutions per minute. This engine is the outcome of several years' development after extensive experience with this class of engine, as a result of which the makers decided that the direct injection system offered the greatest promise of success. As is generally known by oil engine designers, one of the most important factors which influences the performance of these engines is the rate of pressure rise on ignition.

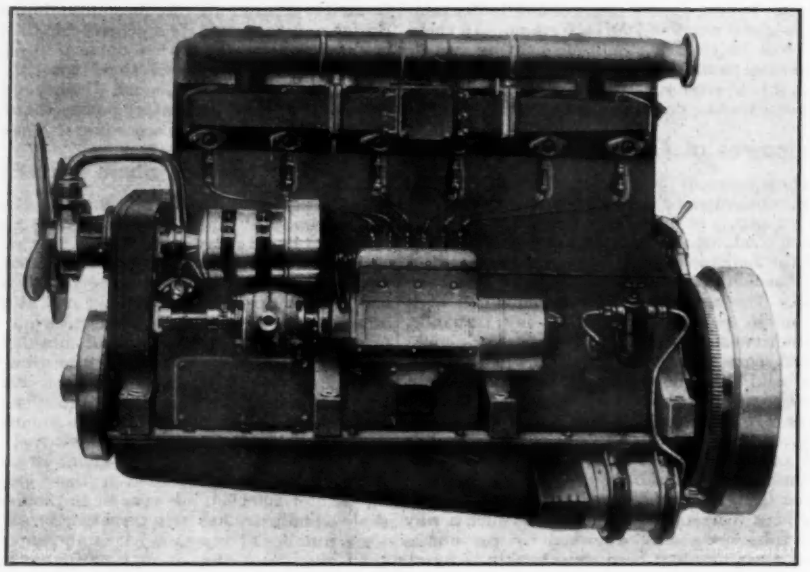
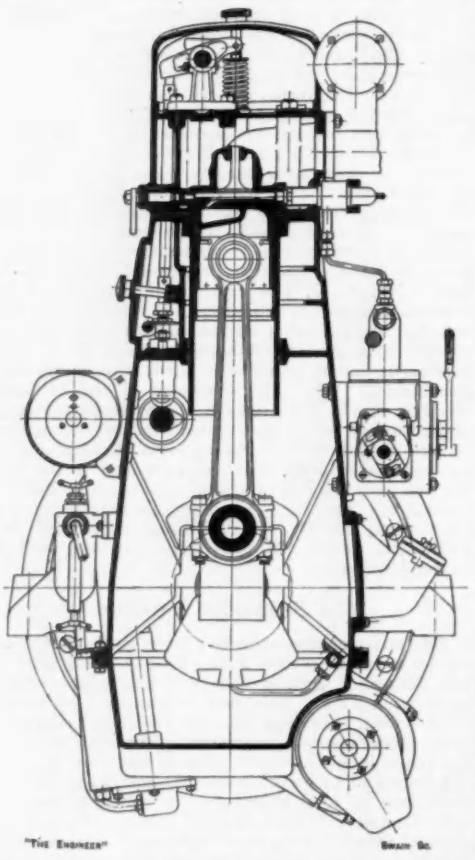


FIG. 25—90 B.H.P. SIX-CYLINDER HEAVY-OIL ENGINE—FOWLER



"THE ENGINEER" SWAIN &c.

FIG. 26—SECTION THROUGH OIL ENGINE—FOWLER

Too rapid ignition causes detonation and knocking. During the course of Messrs. Fowler's experiments it was found that, by providing an extra air chamber in the piston head, the detonation could be cut down without affecting either the efficiency or the ease of starting. With this arrangement the quantity of air in the combustion chamber proper is reduced so that, when the charge of fuel is first injected, it burns with a shortage of air and combustion is consequently retarded. Then, as soon as the piston starts on the downward stroke, the air in the piston chamber is released and combustion is continued. We are informed that tests have proved that no combustion takes place in the air chamber, so that no carbonisation or overheating of the piston is produced. On the other hand, it is claimed that the greater turbulence imparted to the charge assists in effecting complete combustion, higher maximum speeds, and a clean exhaust. A transverse section of this engine is given in Fig. 26, and a sectional view of one of the pistons in Fig. 27. The cylinders are cast in one piece with the crank case and they have liners of special spun cast iron to withstand hard wear. The combustion head is designed for the direct airless injection system and the fuel is injected direct into the combustion space. The pistons are fitted with four rings above the gudgeon pin and one scraper ring. Overhead valves operated through push rods and rocking levers from the cam shaft in the crank case are used so as to obtain a symmetrical combustion chamber with the largest possible valve area. The rocker arms are mounted on roller bearings. Lubrication is by means of a pressure pump in the crank case sump, and the oil is delivered through the crank shaft to all main and big end bearings, gudgeon pin bushes and cam shaft bearings. For the injection of the fuel the Bosch system, with a separate pump and nozzle delivering a measured quantity of fuel direct to each cylinder, has been adopted. A governor is connected to the pump control to limit the maximum speed. There is also hand control to regulate the quantity of fuel supplied, while for light loads one cylinder can be cut out entirely. An additional control enables the time of injection to be varied according to the speed. A half-compression device is provided for easy starting. Engines having from one to three cylinders can be pulled over by hand, but engines with four to six cylinders require either an electrical or mechanical starter. A fan mounting is fitted on the engine with a friction drive through helical gearing. The engine is totally enclosed and has an air filter on the air intake pipe.

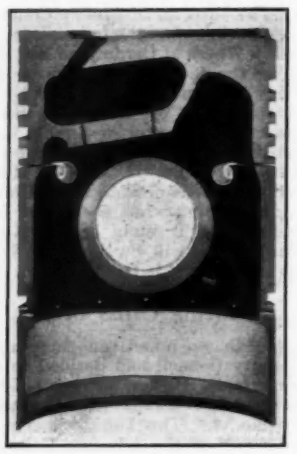


FIG. 27—SECTION THROUGH PISTON

J. AND E. HALL, LTD.

A motor van shown by J. and E. Hall, Ltd., Dartford, was arranged as a demonstration vehicle for the "Hallmark" automatic refrigerating machines. The details include a small refrigerated cold chamber, fitted up in a similar manner to those used by retail butchers, a direct-expansion milk cooler, and an automatic ice cream freezer. All these appliances are cooled by methyl chloride refrigerating machines, which, except in the case of the milk cooler, operate with automatic control. Power is supplied by a Stuart-Turner petrol-electric generating set mounted on the lorry.

AUTO-MOWER ENGINEERING COMPANY.

A self-anchoring winch fitted to a Fordson industrial tractor shown by the Auto-Mower Engineering Company, Ltd., Norton St. Philip, near Bath, is claimed by the makers to be a distinct advance in design upon previous winches. The winding drum is situated at the front of the chassis and the rope passes underneath the tractor between rope guide rollers at the rear. The rear roller is of necessity close to the ground, but is so constructed that should a protruding obstacle be encountered, it pivots about the cross shaft through the chassis, and so prevents damage. This method of hinging allows the rollers to be raised sufficiently high so that the existing tractor draw-bar lug may be employed when necessary. The additional stresses set up by the application of a winch are, by the arrangement of the drum and anchor, all absorbed within the chassis, and are not imposed upon the tractor.

The method of anchoring adopted is automatic and positive, and enables a very high draught to be obtained, while the winding drum is equipped with a brake operated from the driver's seat, which prevents drum spin when the rope is being paid out.

GENERAL ELECTRIC COMPANY.

In our second article on the Show, we referred briefly to the portable electric farm motor exhibited by the General Electric Company, Ltd., which was awarded one of the Society's silver medals. The arrangement of this motor, which is shown in Fig. 28, is such that it can be rolled anywhere on a farm where motive power is required. It is robust in design and can be turned in its own length. There is no gearing or countershafting, but it is fitted with a two-step driving pulley to give two speeds. The motor, which is of the squirrel-cage induction type, with a cast aluminium alloy rotor running in ball and roller bearings, is housed with its starter in a sheet steel drum. When not in use, the flexible cable, by which the current is led to it, is coiled round the drum and a recess is provided for the plug connections. To hold the motor in position when driving machinery, there are collapsible feet, which are shown dotted in their lowered position in the illustration. The starter is an air-break, iron-clad, three-pole contactor circuit breaker, with no-volt and three overload trips and self-contained start and stop buttons. Each motor is supplied with a wall plug connection, consisting of an interlocked switch plug and socket with earth connection.

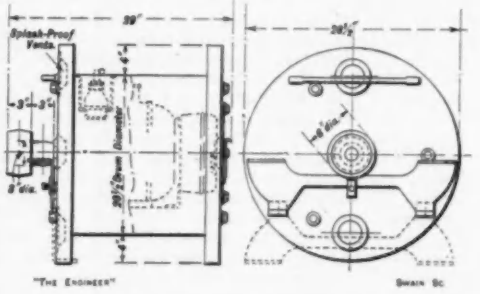


FIG. 28—PORTABLE ELECTRIC MOTOR—G.E.C.

HOPE'S HEATING AND LIGHTING COMPANY.

An actual working plant comprising a boiler and oil burner for central heating and lavatory purposes was shown by Hope's Heating and Lighting Company. This plant is automatic in action from the time the electric motor is started, the burner starting and stopping by means of thermostatic controls. The burner has only two moving parts, namely, the motor and the pump, and the oil is atomised mechanically. It is sprayed in the form of a mist into the fire-box of the boiler, where it is mixed with air in correct proportions, and ignited by electric spark. A feature of this oil-burning system is the quietness of its working. It can be applied to almost all boilers, and most existing coal-fired boilers can be converted by forming a combustion chamber in the boiler and adding the necessary controls.

GARRETT'S.

The new tractor shown by Richard Garrett and Co., Ltd., of Leiston, is propelled by a high-speed compression-ignition engine, either the Invicta, made by Avelings, or the Blackstone spring injection engine with four cylinders. The Aveling engine is fitted with a Bosch pump and injection system, and the engine block and crank case is a one-piece casting. The engine has renewable cylinder liners, and is fitted with a special device, whereby it is impossible to run the engine if the supply of lubricating oil

* No. III. appeared July 17th.

fails. It can be started by hand, but if mechanical starting is required, a suitable dynamo with batteries and starting motor are provided. The Blackstone engine operates on the four-stroke principle, with separate fuel and injector pumps on the firm's spring-injection system. The engine and crank case are a one-piece casting, and renewable cylinder liners are fitted. It is equipped with a small air-cooled starter, which automatically cuts out when the engine starts. By running continuously day and night for 977 hours, the Garrett tractor fitted with an Aveling Invicta engine established a new endurance record for farm tractors. Throughout October and November, 1930, it worked day and night up and down the Berkshire hillsides, stopping only for re-fuelling or changing the ploughs, but with the engine running all the time.

L. R. KNAPP AND CO., LTD.

On the stand of L. R. Knapp and Co., Ltd., Clanfield, Oxford, we were shown a new "Monarch" hay loader driven by two straight chains, both of which are drivers, and both run at the same speed, whether either or both wheels be driving. By eliminating cross chains practically all chain troubles are minimised, and, because the crank shaft is positively driven from both sides all the time, the risk of a bent or twisted crank shaft is halved. These improvements have been made possible by introducing a countershaft driven through gearing with ratchet escapements on both wheels. Other improvements include larger trailer wheels and a new method of adjusting the delivery chute, which can be lowered as well as raised by the man on the cart. Another new machine is the Knapp tractor drill, a one-man equipment controlled entirely by the tractor driver. It sows seventeen rows 7in. apart and one man with a light tractor, and it can cover 2½ to 3 acres an hour. The coulters are put into work and the seed runs started by a single pull on a cord. A second pull lifts the coulters and at the same time stops the seed running to them. The seed, therefore, is delivered only when the coulters are in work. There are three sowing depths: shallow, medium, and deep. The force feed mechanism is on the firm's standard principle. The feed rollers have large corrugations which do not damage the seed, and the rate of sowing is adjusted by moving the rollers laterally in and out of action. By fitting two large seed boxes and by the arrangement of the coulters in two rows, the number of stops for refilling is reduced and the coulters in each row can be widely spaced to prevent reeving. The forward seed box is mounted higher than the rear box, and, as the feed mechanism is in the front of each box the driver from his seat can watch the seed running to every coulter. Both wheels are drivers and the lifting and pressing mechanisms are positively driven from both ends.

RANSOMES, SIMS AND JEFFERIES.

The exhibits of Ransomes, Sims and Jefferies, Ltd., of Ipswich, covered a very wide range of appliances, lawn mowers of both motor and manual patterns being prominent features. All the motors are of the four-stroke type, except that used on the 14in. machine, which is a two-stroke engine. The farm implements included ploughs, mowing machines, mole drainers, subsoilers and cultivators. Amongst mowing machines one called the "R.10" has several important features in its construction, including a new finger bar which gives a scissor-like cutting action, and this, together with simplicity of gearing, reduces the draught. The wings of the fingers are solid, having no spaces between them, so as to prevent grass or other materials from entering. They are also streamlined on the underside and are fitted flush with the steel cutter bar, so as to enable the latter to pass any obstruction without fouling or choking the knife. The sections overhang the knife back, and additional wearing plates, which serve two purposes, have been provided. They prevent anything entering the finger bar from the top and they form a bearing surface along the whole length of the bar for the knife to run on. The knife runs in the channel formed by the solid finger, and as that is practically oil retaining, the knife runs in what is virtually an oil bath. The self-lift tractor cultivators made by this firm have several features of merit. For instance, the tines are interchangeable and those on the outside follow and cut out the wheel tracks. The lifting mechanism is so designed that either wheel will lift the cultivator, whilst the other is stationary as when turning. A tractor cultivator for aerating grass land is fitted with turf cutting blades which open out the old turf so that air and manure can penetrate into the soil beneath it with beneficial results. Ransomes, Sims and Jefferies, Ltd., having taken over the distribution of Hornsby ploughs and implements, showed a group of that firm's products, including a binder, trusser, seed drills, mowing machines, and ploughs.

BLACKSTONE AND CO.

Oil, petrol and paraffin engines representative of the smaller sizes of power plant made by Blackstone and Co., Ltd., of Stamford, were shown in the machinery in motion section. A 64 B.H.P. twin-cylinder spring-injection heavy fuel oil engine was to be seen driving a 40-kW generator for the supply of current for lighting the group of stands occupied by the other companies associated in Agricultural and General Engineers, Ltd. Other engines fitted with spring fuel injection shown were of the single-cylinder pattern, while for farmers' use there was exhibited a range of engines from 5 to 14 B.H.P. mounted on skids, which can be started from cold by hand. For the propulsion of transport vehicles Blackstone's four-cylinder vertical high-speed heavy fuel engines have already found many applications. Since 1928 this firm has devoted its experimental and manufacturing resources to the production of this simple spring-injection engine, which is now made in three powers, namely, 18/20, 36/40, and 55/60 B.H.P. Their fuel consumption is said to compare favourably with that of other systems.

SOME NEW IMPLEMENTS.

In our issue of July 10th we referred to the new mowing machine with automatic lubrication of the working parts, shown by Bamfords, Ltd., Uttoxeter, and we are now able to present sectional drawings of this machine in Fig. 29, which show how the gearing, bearings, as well as the thrust and clutch gear are kept well supplied with oil without the aid of the old-fashioned oil can.

A new implement shown by Harrison, McGregor and Co., Ltd., of Leigh, Lancashire, is a mowing machine fitted with a forced lubrication system, a special finger bar and a vertical lift. In this machine oil is supplied to the main bearings of the machine by means of a gear pump situated in a sump attached to the underside of the gear-box, and the return oil is fed back through the return pipes to the sump by gravity. The pump is driven from the cross shaft of the machine by means of sprocket wheels and a bush roller chain enclosed in a chain case, the drive being so arranged that the pump is only in operation when the machine is put into gear. On the finger bar those portions of the fingers which act as seating for the knife back are provided with renewable liners made from hardened steel, and these liners are so constructed that the bolt which fastens the finger to the finger bar also fastens the liner. To work in conjunction with the fingers, knife brackets of a special design are fitted to the finger bar and are so arranged that each section is guided during its complete travel. We understand that separate patents are pending for the forced feed system of oiling, the finger bar and the method of supplying oil to the crank pin. The machine, which is known as the "Albion," is shown in Fig. 30.

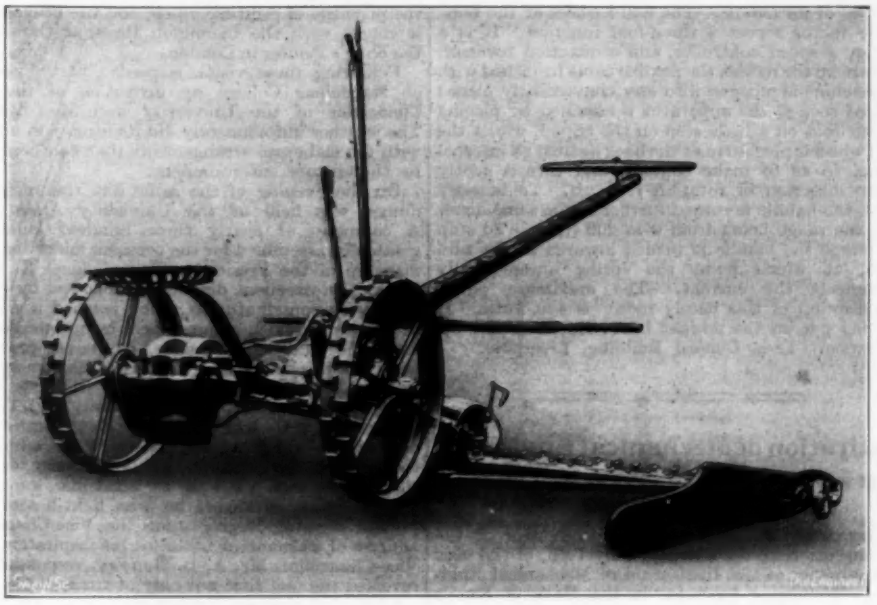


FIG. 30—MOWING MACHINE WITH FORCED LUBRICATION—HARRISON, MCGREGOR

One of the machines entered for the Silver Medals—which did not, however, prove to be successful—was the "Kartof" liquid sprayer, invented by Mr. Winkel, a Danish engineer. This machine is specially designed for preventing the diseases of potatoes. In contradistinction to the many fine nozzles of other spraying systems, the "Kartof" machine has only one pipe, about 1in. in diameter, which allows a discharge of 6 or 7 gallons of liquid per minute. The spraying device consists of a horizontal disc which revolves at about 1500 revolutions per minute and spreads the liquid over a zone 8ft. to 13ft. wide. The revolving disc is driven by a chain from the road wheels on which the machine is carried, and there are no pumps, pressure tanks, or other devices which

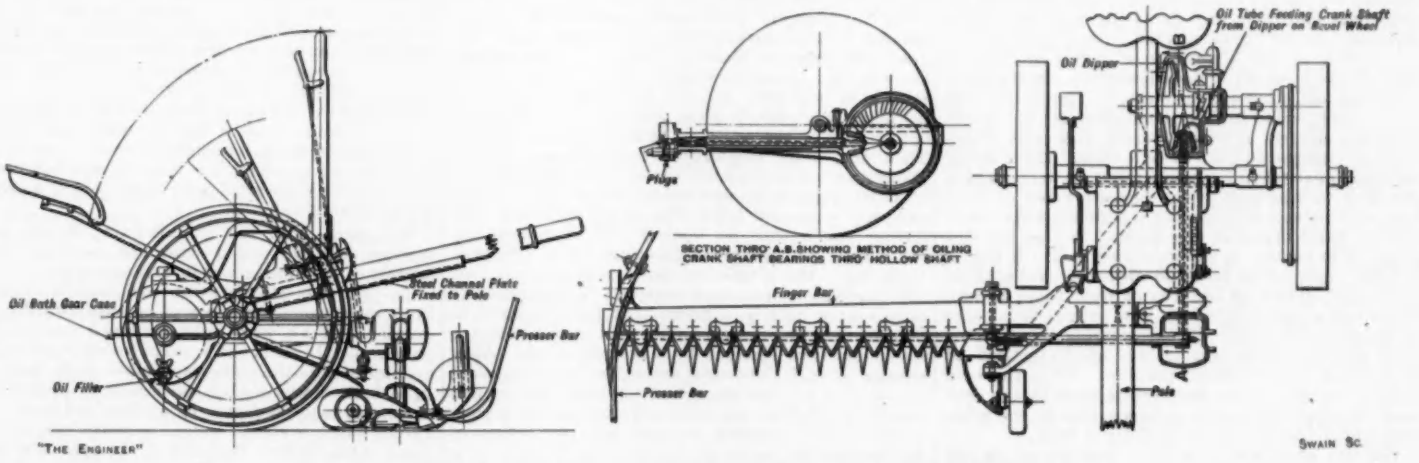


FIG. 29—MOWING MACHINE WITH AUTOMATIC LUBRICATION—BAMFORDS

are liable to get out of order. The machine is easily drawn by two horses, and the quantity of liquid used is regulated from the driver's seat. It weighs

about 880 lb. and can cover, we are informed, about 24 acres per day. The representative for the makers in this country is Mr. R. Pedersen, 68, Creffield-road, London, W. 3.

We were impressed by the wide range of applications to farm and estate work of the "Law" portable electric motor. This motor is designed to perform any work about the farm which is ordinarily done by the turning of a handle. It is of the repulsion-induction type, which enables it to be started from rest against full load and is wound to operate on single-phase A.C. The weight is only 60 lb. An illustration on the stand showed the motor applied to an old-fashioned handle pump on a Leicestershire farm, where it is pumping 400 gallons of water per hour. The crank attachment was made by the local blacksmith. The support is a strong—tubular steel—tripod with a quick-acting lever adjustment for altering the height and facilitating alignment and connection to the machines to be driven. At the driving end of the motor there is a triple-train reduction gear, running in grease, and enclosed in a dust and waterproof casing. The gear-shaft couples directly, by means of a sleeve, to the shaft of the driven machine in place of its handle. The hand wheel at the back of the motor serves a three-fold function. It is a starter, a speed controller, and a direction reverser. To start up the motor, the flexible cable furnished with the machine is plugged into any conveniently placed earthed socket, the apparatus is steadied by placing the left foot on a little step on the tripod, whilst the hand wheel is pressed in at the back against an internal spring, so as to make contact, and turned gently in the direction of rotation required. To increase speed, the handle is turned further in the same direction, the range being from 0 to 200 r.p.m. To stop the motor the handle is turned inwards to the zero mark, at which point the spring automatically disconnects the current. The maximum power consumption of this handy motor is 400 watts. It is being put on the market by J. Harrison and Co. (Liverpool), Ltd., Cunard Building, Liverpool.

Institution of Mechanical Engineers.

SUMMER MEETING AT CAMBRIDGE: VISITS AND SOCIAL ENGAGEMENTS.

LAST week we recorded the proceedings at the opening meeting, on Tuesday, July 14th, of the visit to Cambridge of the Institution of Mechanical Engineers. Following luncheon in the Halls of King's College and St. John's College, the visitors were divided into two parties and were conducted round some of the colleges by members of the University. In the evening a reception and dance were held at the Guildhall by invitation of the Mayor, Councillor Edwin Jackson, and the Mayoress.

On Wednesday, July 15th, there were alternative visits in the morning to the works of the Cambridge Instrument Company, the Pye Radio Works, Chivers' orchards and jam factory at Histon, Eastwood's Cement Works at Barrington, and Towgood and Sons' papermaking works and factory at Sawston.

It is always a noticeable feature of the Institution's summer meetings that some of the best attended visits are those paid to establishments which are not directly connected with engineering. Several obvious reasons for this fact might be suggested, but one will suffice. It is in factories and establishments of a non-engineering character that engineers are most likely to encounter processes of manufacture and systems of organisation which are new to them and which may be helpful or inspiring in their own work. On the occasion with which we are now dealing the visit to the Histon orchards and jam factory attracted a large number of the members. Even those who went to the factory with a proper disregard for popular statements concerning the ingredients which sometimes find their way into jams must have been surprised at the excessive care exercised at Histon to maintain as high a standard of purity and cleanliness as the most scrupulous housewife could desire. The jams and other products are, it is scarcely necessary to say, boiled in silver-lined pans and the operatives are clothed in white overalls and caps, which must be changed at least twice a week. These things we might have taken for granted, but we were scarcely prepared to find that every separate berry of every kind of fruit was subjected to examination and selection by hand before it was allowed to pass into the pans. The factory is self-contained in so far that it is fully equipped to make its own cans and packing cases, and draws its supplies of fruit from its own surrounding orchards, which now extend to an area of about 6000 acres. Chicken-rearing, bee-keeping and pig and horse-rearing are also practised at Histon, all with a double purpose. Thus the hens supply the eggs for the lemon curd made by the firm, and, roaming through the orchards, feed on the grubs which might otherwise attack the fruit trees.

On the same day, luncheon was served to the visitors in the Halls of Caius College and Trinity College, and in the early afternoon short visits were paid to the Low Temperature Research Station established by the University in conjunction with the Department of Scientific and Industrial Research, or, alternatively, to the Cambridge University Press. Both visits proved attractive. At the Low Temperature Research Station, Sir William B. Hardy and his staff demonstrated the work now being done on the effect of low temperatures on foodstuffs. The station is equipped with thirty-two chambers, in which temperatures from 75 deg. to 30 deg. Fah. can be maintained. Thermo-static controllers enable the chambers to be preserved at a given temperature to within one-twentieth degree, day and night, all the year round. The station also includes various laboratories and a complete small-scale canning factory. At the University Press the visitors had an opportunity of studying the modern machine method of setting type by the Monotype process, and of examining some of the famous books which the establishment has produced, including some made in 1584 and in the immediately succeeding years by Thomas Thomas, the first printer, and the beautiful and justly famous Cambridge bible, printed by John Baskerville in 1763. The Press produces, on the average, two new books a week. It is particularly well equipped for dealing with works in ancient and modern foreign tongues. By far the principal constituent of its output is still the Bible, the privilege of printing which, and the Prayer Book, it shares with the Clarendon Press at Oxford and the King's Printer in London.

Following these visits, a garden party was held at Magdalene College by invitation of the Vice-Chancellor of the University and Miss Ramsay. The weather unfortunately did its utmost to interfere with the elaborate arrangements that had been made for the visitors' entertainment.

On the evening of the same day the Institution dinner was held at the University Arms Hotel. A company of nearly three hundred ladies and gentlemen assembled for the occasion under the chairmanship of the President, Lieut.-Colonel E. Kitson Clark. An excellent dinner was followed by a toast list, every contributor to which reached a standard of eloquence and humour which, in our considerable experience of such occasions, has never previously been approached. Mr. E. Bruce Ball more than justified the President's choice in selecting him to propose the toast of "The University and Town of Cambridge." He touched with just sufficient seriousness on the subject of Professor Inglis' address on the previous day, emphasising the necessity for workshop experience as well as academic knowledge. In the main, however, he was light-hearted and joyous, drawing largely upon the Vice-Chancellor's address of welcome in Latin for his inspiration. The Vice-Chancellor, Mr. A. B. Ramsay, responded. He revealed the fact that not only at times did he speak English, but that his English was as beautiful as his Latin, and that his study of the classics had done nothing to becloud his sense of humour. Latin, he explained, was the only language in which a speaker could be pompous and not ridiculous. Casting pomposity aside, he told us that, according to one dictionary which he had consulted, engineering meant any means designed to accomplish an end, particularly a bad end. How, he asked us, had engineers come to acquire their title? It was derived from *ingenium*, which meant native ability. Was it by constant repetition of the assertion that we had persuaded the rest of the world that we were the sole repositories of ingenuity? He was glad to observe that, on the following day, we were given a choice of visiting either the races at Newmarket or the cathedral at Ely. The conjunction of these two alternatives revealed the fact that, after all, engineers did possess something of that wide range of interests which was commonly identified with a classical outlook.

The Mayor of Cambridge also responded to the toast, and in a different, but no less entertaining, manner maintained the happy standard set by the previous speakers. He told us of the negotiations which led to the holding of the meeting at Cambridge, and recalled incidents in his and the President's lives when they were at school together.

To the toast of "The Guests," proposed by Lieut.-Colonel Kitson Clark, in his usual genial style, Sir Joseph J. Thomson, Master of Trinity College, replied. He was in a reminiscent mood. He started life, he said, as an engineer. In 1871, at the age of fourteen, his name was placed on the waiting list of would-be apprentices at the works of Sharp, Stewart and Co. Then one, John Hopkinson, from Owens College, Manchester, succeeded in becoming senior wrangler at Cambridge, with the result that Owens College suddenly emerged from obscurity, and with the further result that he himself was sent there by his father to study engineering under Osborne Reynolds. The professors, he said, were good, but the buildings in those days were bad. The engineering classes were held in a house that had belonged to Cobden, and the drawing-office was in the loft of a stable, and was reached by a homely ladder. After passing through the course and taking the certificate, he took to mathematics and physics, but he was glad to recall that his early training had been such that he was qualified to join the Institution of Mechanical Engineers.

The toast of the President's health, proposed by Lord Rutherford and acknowledged by Lieut.-Col. Kitson Clark, brought to an end at a late but not too late hour as enjoyable a dinner as, by common agreement, the Institution has ever held.

On Thursday, July 16th, a large party—headed, we are bound to record, by the President—proceeded to Newmarket, where, or so we heard afterwards, much that was of interest and little that was profitable was found in the working of the totalisator. A more sedate party proceeded by motor launches down the river Cam to Ely, where, under the guidance of the Dean, the glories of the ancient cathedral were inspected. Before leaving by road for Cambridge some of the members of this party paid a visit to the Ely Beet Sugar Factory. Refining was in progress, but elsewhere the establishment was in a state of overhaul following the conclusion of the season's "campaign."

A third party, bent sternly on business, left Cambridge at an early hour for Northampton, principally for the purpose of visiting certain boot and shoe factories. In the evening a conversazione was held at the Engineering Laboratory, by invitation of Professor C. E. Inglis and Mrs. Inglis and the staff of the University Engineering Department. The conversazione virtually coincided with the completion of the department's new accommodation. The laboratory is planned on a very generous scale and includes electrical, wireless, heat engine, structural, hydraulic and metallurgical sections, together with numerous lecture rooms and workshops. About 500 students attend it, and although the University was not in session at the time of the meeting, many of them were present to demonstrate to the guests the working of the equipment in the laboratory. A particularly interesting section for those who visited it, was the workshop and hangar of the Cambridge University Air Squadron. We found this section to be very well equipped with several demonstration aeroplanes and aero-engines, with a wind tunnel and other model testing equipment and with an improved form of autographic cockpit for testing the flying aptitude of would-be pilots.

On Friday, July 17th, the last day of the meeting, a limited party visited Wretham Hall, by invitation of Sir John Dewrance and his daughter, Mrs. Rich. On the outward journey a pause was made at Bury St. Edmunds to inspect the Abbey ruins, and on the return journey a brief call was made at Brandon for the purpose of inspecting the flint knapping works of Mr. V. R. Edwards, where gun and building flints are still produced. A second party proceeded to Peterborough, where visits were paid to the works of the London Brick Company and Forders, the Ketton Portland Cement Works, the Peterborough Electricity Generating Station, and the works of Messrs. Barford and Perkins and of Messrs. Baker Perkins.

A third and numerous party travelled by train to Letchworth and thence proceeded to the Royal Air Force Home Aircraft Depôt at Henlow. Under the guidance of the officer commanding, Group Captain A. V. Bettington, and his staff, the workshops, in which all the machines involved in accidents and not irretrievably damaged are repaired, were inspected. The depôt buildings cover a large area, for they represent the survival of a wartime establishment. The work carried out consists mainly of the repair of damaged aircraft, but the depôt also contains an officers' engineering training department and has complete charge of the testing, issue, re-folding and re-issue of the Air Force's parachutes. The visitors were permitted to inspect at close quarters the manner in which a parachute is folded within its case and how it unfolds itself when the pilot jumps and after counting three pulls the release ring. A demonstration test was given in the air with eight parachutes, each carrying a dead load of 2 cwt. and released in succession from a chamber specially arranged beneath the body of a Vickers "Vimy" machine.

Following luncheon in the Officers' Mess, the party returned to Letchworth and, dividing up into several bodies, visited the steel foundry of Messrs. Kryn and Lahy, the city waterworks, the Marmet Baby Carriage Factory, Messrs. Shelvoke and Drewry's motor freighter works, and the Spirella Company's factory. Here was a choice of interests truly classical in its breadth of outlook. We hesitate to name one of the visits, which proved as popular with the men as with the ladies, but even in corsets there is much that is of interest to engineers. Certainly the visit to the Spirella Company's works was well worth the time spent upon it. It showed those who were bold enough to undertake it, what a factory under garden city conditions can be made to be, and provided a revelation of the extent to which it is possible and desirable to carry welfare work among the employees of a modern industrial establishment.

We began with the manufacture of jam in an orchard and we ended with the manufacture of articles of feminine attire in a surrounding of flower beds. The two establishments had much in common. Both were producing goods of an exceptionally high standard. Both were fully employed and patently prosperous. In each, the workers' health, comfort and happiness were the subjects of close study and care. In both, there was present the possibility of monotony of employment, a factor in modern industrial conditions which is strong enough to wreck the best-laid plans of the welfare department. In both, monotony was successfully avoided by the simple expedient of training each worker to operate a variety of processes or machines and of giving her a frequent change of duties.

Distribution of Gas from French Coalfields.

IN a recent issue our French contemporary *Le Génie Civil* gave a detailed description of the installation which is in operation transmitting gas obtained as a by-product of the coke ovens at mines in the Pas-de-Calais to Lille and other industrial towns, to the northward of that area. In what follows we give the gist of that description.

The undertaking in question has for some little time now been operated by La Société Régionale de Distribution du Gaz (S.R.D.G.). The gas transmitted is obtained from the coke ovens of (*a*) Lens, at Pont-à-Vendin; (*b*) Courrières, at Harnes; (*c*) Dourges; and (*d*) Drocourt, both at Hénin-Liétard. It is fed into the distribution networks of Lille, Roubaix, Croix, Seclin and Carvin through mains stretching for a distance of 40 kiloms. as the crow flies, and having a total length of 64 kiloms.—see Fig. 1. The gas from the four cokeries is taken by duplicate collectors to a feeding main 600 mm. in internal diameter, which conveys it to Lille, Croix and Roubaix, supplying the smaller towns of Carvin

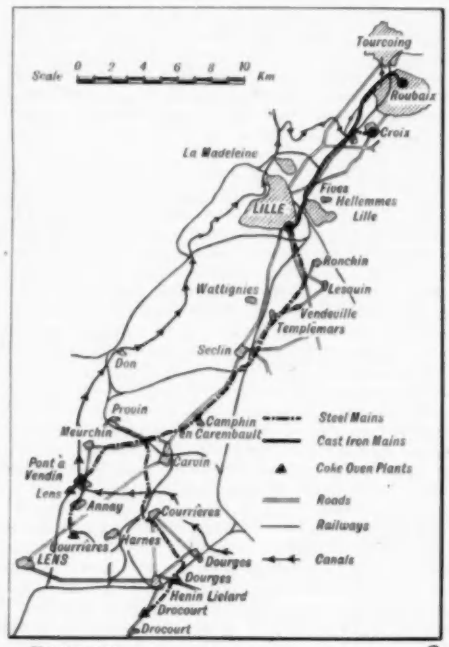


FIG. 1—ROUTE OF GAS MAIN

and Seclin on the way. The aggregate of the populations supplied amounts to more than 700,000 persons, and at the present time the system is transporting from 170,000 to 200,000 cubic metres—say, between 6,000,000 and 7,000,000 cubic feet—per day. The gas is, of course, compressed before being delivered to the transmission mains, the pressure employed being in the neighbourhood of that due to a column of water from 3 m. to 4 m. high, which represents a pressure of some 4½ lb. to 5¾ lb. per square inch.

THE GAS MAINS.

The transmission mains were calculated on a basis of a maximum eventual daily transmission of 600,000 cubic metres, which will necessitate maximum initial pressures of between 8 m. and 10 m. of water, or, say, from 11½ lb. to 14¼ lb. per square inch. To determine the most economic all-round conditions of operation corresponding to this daily transmission, two main considerations were taken into account: (1) The first cost of the mains—which is the greater as the diameter increases—and (2) the annual cost of compressing the gas—which is the greater as the diameter is decreased. Actually, what is known as the "Chicago" formula was employed to arrive at the desired result. The formula is:

$$P = \sqrt{K Q^2 L + p^2}$$

where P and *p* represent the absolute pressures in centimetres of water of the gas at the inlet and discharge ends of the main, respectively; L the length in kilometres of the main; Q the transmission in hundreds of cubic metres per hour; and K a coefficient which is a function of the specific gravity of the gas and of the diameter of the pipe. This formula, says our contemporary, as applied to the Lille system, has given results which approach very nearly to those actually met with.

Another point which had to be decided was the nature of the metal of which the mains were to be made. It is pointed out, by our contemporary, that the Germans have, apparently, definitely chosen steel for the transmission of gas under pressure over long distances. They fear the disabilities of cast iron—its brittleness, its porosity and the feebleness of its resistance to efforts of expansion—which limit to a comparatively low figure the initial pressure to which the gas can be compressed and, hence, the volume which can be transmitted by a main of given diameter. As against that, however, cast iron, undoubtedly, resists to a greater extent than does steel the corrosive action of soils; it is cheaper, and the way it behaves in the ground is well known. Steel, on the other hand, corrodes readily under the action of chemical agents and stray electric currents, and has, therefore, to be very carefully protected; it is, generally, dearer than cast iron, but it permits of the use of units of greater length than cast iron, which means a reduction in the number of joints in a main of given length, and joints introduce weak points.

DETAILS OF THE PIPE LINE.

For the pipe line we are discussing it was decided to lay down, in different sections, the type of pipe regarded as being best suited to the particular conditions. In the mining area, where the pressure of the gas is highest and where subsidences of the ground owing to subterranean excavations are to be expected, the pipes are of steel. To avoid the corrosive action of the soil, the bodies of the pipes are coated both inside and out with a tar compound, and are protected, in addition, by a wrapping of asphalted jute, the continuity of which was made certain of by inspection before the pipes were laid. The joints, too, were carefully wrapped, after the pipes were got into position, with suitable material, which not only completely covered the entire joint itself, but was also made one with the pipe wrappings on either side of the joint.

Beyond Lille, where the pressure of the gas is not so high, since a large quantity has been delivered to consumers, and where, as it is well outside the mining district, subsidences of the ground are improbable, the advantages of cast iron more than counterbalanced its disadvantage, and it was decided to employ pipes of that material to the northernmost limits of the transmission pipe line.

For carrying out the work tenders were invited from several firms which were considered best capable of undertaking it. After studying the various proposals made, the S.R.D.G. gave the order for the steel pipes to la Société des Aciéries et Usines à Tubes de la Serre (A.U.T.S.), and for the cast iron pipes to la Société des Hauts Fourneaux a Pont-à-Mousson. The diameters of the pipes employed were 325 mm., 400 mm., 450 mm. and 600 mm.—say, from just under 13in. to just over 23½in. The 325 mm. pipes, which are of weldless steel, were made by the A.U.T.S. at Bous-sur-Sarre. The 400 mm., 450 mm. and 600 mm. pipes are of steel plate, lap-welded after being heated by water gas. They were made by les Usines d'Escaut-et-Meuse at Anzin. The 325 mm. pipes are about 9 m. long and the larger pipes, which were made up of two cylinders welded circumferentially in the same way as the longitudinal joints, were 10 m. long. The thicknesses of the various pipes were as follows:

Diameters, mm...	325	400	450	600
Thickness, mm. ..	8·5	6	6	7

The 325 mm. pipes were subjected to a test pressure of 75 atmospheres, while those of greater diameter were subjected to a pressure of 20 atmospheres. The tensile strength of the metal for the 325 mm. pipes was specified as from 55 kilos. to 65 kilos. per square millimetre, while that for the larger diameter pipes was specified as from 30 kilos. to 40 kilos. per square millimetre. The elongation of the 325 mm. pipe metal was specified at from 10 to 15 per cent., and the elongation for the pipes of larger diameter was to average 24 per cent. Tolerances of 2 per cent. in the diameter of the weldless pipes and of 1 per cent. for the welded pipes were allowed, as were also 10 per cent. in the thicknesses and 10 per cent. in the weights.

All the pipes were carefully examined at the site before

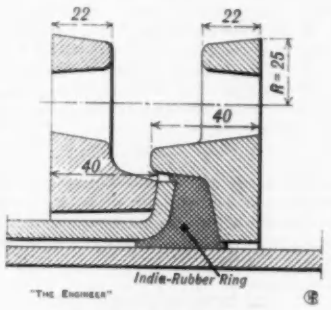


FIG. 2—GAS MAIN JOINT

being laid, so as, principally, to make certain that the protecting jute wrapping had not been damaged in transit. Finally, before the material was filled in upon them in their trenches, the lines of pipes were subjected to a test air pressure of 3 kilos. per square centimetre in lengths of 2 kiloms., as a maximum, for the 600 mm. diameter pipes, and of 3 kiloms. for the pipes of less diameter. This pressure was maintained for two hours and was followed by a hydraulic test under a head of 2 m. for 15 minutes. Other tests were also applied.

The joint, known as the "Standard," which was devised by the A.U.T.S. in collaboration with the S.R.D.G., is shown in Fig. 2. The metallic parts of this joint are of cast steel and a larger number of bolts than is customary with cast iron pipe joints of similar diameter was employed. This arrangement is said to give considerable flexibility and to possess great mechanical strength, the joints keeping tight even when considerable movement of the ground is experienced. In fact, during the operations of laying the pipes, a section of the 600 mm. main about 200 m. in length, laid in a trench but not filled in, was, as the result of flooding caused by a sudden rain storm, lifted from its seat in the trench to a height of about 1 m. When the water was got rid of, the floor, which had become lifted in several places, would not allow the pipes to resume their original positions, so that the profile of the pipe line was considerably distorted. In that position a test pressure of 3 kilos. per square centimetre was applied, and the whole length was found to be perfectly tight.

The procedure carried out as regards laying and test pressures with the cast iron pipes were practically the same as those used for the steel pipes.

A certain number of valves was inserted in the length of the mains. The valves in the steel mains are of cast steel, while those in the cast iron mains are of cast iron. They are all enclosed in masonry chambers. The steel valves were subjected to a test air pressure of 5 kilos. per square centimetre. They were made by La Société Métallurgique Haute-Marnaise, which has applied to their type the name of "Comptelux." The valves were placed at such points as would make the eventual operation of the system as easy as possible, their number having been reduced to the minimum possible and their positions chosen so that any particular section might be isolated in case of accident, and so that the greatest number possible of consumers might be supplied with the outputs of the greatest possible number of cokeries.

The gas, before it is sent out from the cokeries, is very nearly saturated with water vapour. In being compressed, it is heated. The compression tends to bring about condensation, whereas the heat generated tends to produce the opposite effect, with the result that the gas retains practically its initial water vapour content. From the moment when it enters the main, however, the temperature of the gas diminishes until, finally, it falls to the same temperature as that of the ground traversed. That occasions condensation. In the meantime, the pressure of the gas falls more and more as the distance traversed increases, so that the

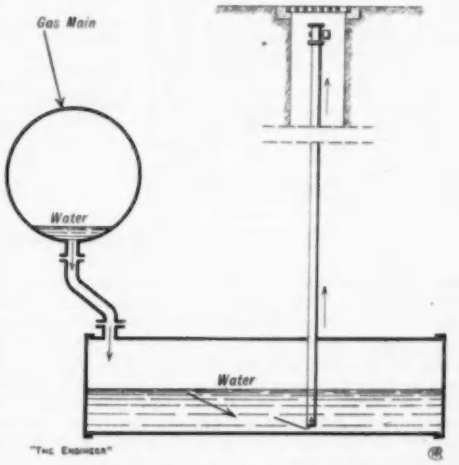


FIG. 3—WATER DRAINING SYPHON

gas quickly ceases to be saturated and no longer deposits moisture on the walls of the pipe. To collect the moisture deposited in the first few kilometres of the main, syphons—see Fig. 3, which is self-explanatory—have been inserted at the lowest points. These syphons have each of them a receiver tank, with a capacity of from 500 to 600 litres, and there are means for discharging the tanks. It was thought unnecessary, at all events at first, to continue these syphons beyond Carvin—see Fig. 1—since, probably, all the moisture likely to be deposited would have been thrown down by the time that point was reached. Yet, as a precaution, pipes capable of being connected to syphons have been arranged at the lowest points in the gas main for some distance beyond that point, for use should they be found necessary.

The first section of the main to transmit gas was that between Pont-à-Vendin, Carvin, Lille, and Roubaix, and gas was delivered into it for the first time on January 12th, 1929. The gas came only from cokeries of the Lens and was taken to Croix and Roubaix. Shortly afterwards the Courrières ovens began to supply gas to the line and were later followed by those at Dourges and Drocourt.

THE MANAGEMENT.

The management of the undertaking is centred at Lille, at which place there is a laboratory containing the necessary apparatus for determining the output, pressure, and composition of the gas. The function of the management is to maintain liaison between producers and consumers, to rectify leaks, to ensure an adequate pressure of gas at the points of delivery, and to control its quality, and the laboratory is open

day and night for those purposes. The gas has, as a minimum, a heating value of 4300 calories, measured in the dry state at a temperature of 0 deg. Cent., and with a barometric pressure of 760 mm. of mercury. Its sulphuretted hydrogen content must be less than that which will cause paper impregnated with acetate of lead to turn brown at the end of a quarter of an hour when held in a current of the gas. The benzole content must be removed in accordance with the law of July 22nd, 1923, and the carbon monoxide content must be lower than the limit set by the Comité Supérieure d'Hygiène—that is to say, 15 per cent.

Cokeries of the Lens Mines.

The installation at the Lens mines for producing and preparing the gas for delivery to the transmission main comprises five batteries of ovens capable of dealing together with some 3000 tonnes of coke per day. Batteries 1 and 2 are composed of pre-war type "Koppers" ovens, which were reconstructed after the war exactly as they had been before it, and on their original foundations. Each contains seventy cells, 0·5 m. wide. The coking time is 23 hours, charging and recharging times included. Each battery produces 400 tonnes of coke per day. Batteries 3 and 4 are of the "Davicion" type, and were built immediately after the war. Each contains seventy cells, 0·44 m. wide. The coking time is about 18 hours, and each battery produces about 700 tonnes of coke per charge. Battery 5, which is of more recent date, contains "Becker" type ovens, comprising fifty-one cells, 0·44 m. wide, 4 m. high, and 12 m. long. The coking time is 16 hours, and the battery turns out 900 tonnes of coke per day.

The gas coming from the ovens passes first to tubular condensers, in which the tar and ammoniacal liquor are removed, and then to "Pelouse" tar extractors. The mechanical installation comprises (*a*) five electrically-driven turbo-aspirators, each capable of withdrawing 13,000 cubic metres of gas per hour when running at a speed of 5500 r.p.m.; and (*b*) four turbine-driven centrifugal aspirators, each designed to withdraw 20,000 cubic metres of gas when running at a speed of 11,000 r.p.m. The steam is supplied at a pressure of 10 kilos., and is exhausted at a pressure of 2 kilos., say, 142 lb. and 28·4 lb. per square inch, respectively. The exhaust steam is employed for the distillation of the ammoniacal liquor thrown down in the primary condensers. The gas is first sent by the extractors to scrubbers, where it is treated with sulphuric acid to remove the ammonia. The ammoniacal liquors are distilled, and the vapour coming off is re-delivered into the gas main before it enters the saturators.

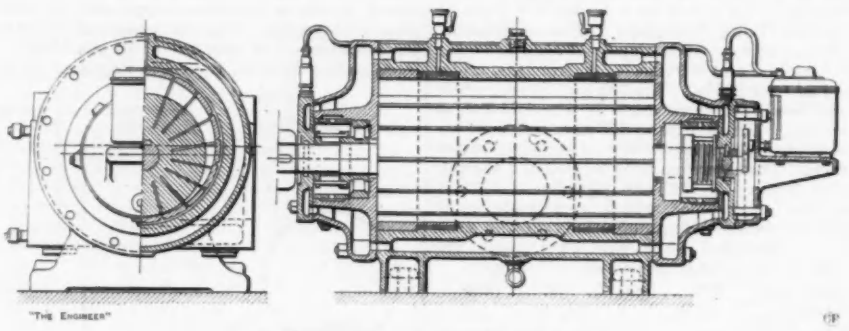


Fig. 4—Winterthur Gas Compressor

From the saturators the gas passes first (1) to the final condensers, where it is cooled; then (2) to the benzol washers, which contain wattle scrubbers, and then (3) to a gas holder. From the latter, about 50 per cent. is sent back to the ovens, while a portion of the remainder is burnt in its raw state, and the rest is purified. The total volume of gas delivered to the holder is about 1,200,000 cubic metres per twenty-four hours. Part of the purified gas is used to operate four gas engines, each of 2500 H.P., which produce power concurrently with steam-driven turbines in a central power-house. A part is also used to operate a synthetic ammonia plant, while the remainder is delivered to the transmission main.

For the first two purposes, purification has not to be carried very far, but, for the portion going into the main, purification has to be much more complete; in fact, not more than 1 mg. of H_2S per cubic metre is allowed to remain. The purification is effected by first of all treating the gas, as in the "Koppers" process, with a solution of sodium carbonate containing iron oxide in suspension. Air is blown through the resulting solution and the sulphur is collected in the form of foam. The installation comprises two groups each designed to treat 150,000 cubic metres of gas per twenty-four hours. From 90 to 95 per cent. of the H_2S is removed by this treatment. After this process the gas passes to two double purifying boxes, each of 100 cubic metres capacity, arranged in parallel. There, the H_2S content is still further reduced, and a portion of the discharge from the plant is used to drive the engines in the ammonium factory. The gas destined for distribution to consumers is driven by compressors through four double purifying boxes, each of 50 cubic metres capacity, arranged in series, in which, it is stated, the purification is complete. The gas finally passes through a meter which has a capacity of 150,000 cubic metres per day, and is then forced into the transmission main by three Winterthur compressors of the form shown in Fig. 4, each of which has a capacity of 3500 cubic metres per hour at a speed of 580 r.p.m. A registering calorimeter is arranged in the circuit before the meter. Tests of the calorific value and of the purity of the gas are made twice a day and complete anaylses of the gas are made every two or three days.

Cokeries of the Courrieres Mines.

The installation of the Courrières mines includes a meter capable of measuring up to 75,000 cubic metres per twenty-four hours. Purification is effected in the dry by means of four purification boxes, of which one is kept in reserve. There are two Winterthur compressors with a capacity of 3000 cubic metres per hour to a maximum pressure of 1 kilo. per square centimetre. These compressors are driven direct by a 150 H.P. 3000-volt electric motor made by La Société Alsacienne. The H_2S content is controlled by an indicating apparatus which is arranged in the circuit beyond the second purifying box. The other constituents of the gas are controlled by frequent analyses made at the laboratory. The regular delivery of the gas is brought about—for flows of less than 1200 cubic metres per hour—by means of a hand-operated by-pass. Beyond that volume alterations are made in the speed of the motor. A non-return valve prevents the gas being forced back through the meter should the compressors be stopped.

Cokeries of the Dourges Mines.

The coking plant of the La Société des Mines de Dourges comprises six batteries of "Koppers" ovens. Two batteries, which produce foundry coke, each have forty-two cells and the coking time is forty-eight hours. The charge for each oven is 10·94 tonnes of moist coal, corresponding to 9·627 tonnes of dry coal. Two further batteries, which produce metallurgical coke, each have fifty chambers and the coking time is twenty-four hours. Two further batteries, each comprising forty-eight chambers, can produce either foundry or metallurgical coke, according to the length of the distillation period. Apart from the gas used on the site, a volume of 165,000 cubic metres or more per day is available for delivery into the transmission main. Purification is effected by the dry process and the installation can deal with 3500 cubic metres per hour. The compression in carried out in two Winterthur compressors—of which one is kept in reserve—each of which can deal with 2570 cubic metres per hour. Each is driven by a 100 H.P. asynchronous motor working on a 50-period, 3000-volt circuit.

Cokeries at the Drocourt Mines.

The cokeries at the Drocourt Mines comprise four batteries of twenty-five ovens, each on the Becker system. Some 2000 tonnes of coal, corresponding to about 1600 tonnes of coke, are dealt with each twenty-four hours. The resulting gas is purified by the "Koppers" process. For delivery to the transmission main there are two motor-driven rotary compressors—one being held in reserve.

The undertaking, which as a whole has, we gather, been particularly successful, forms the most important application in France up to the present of the supply of coke oven gas over long distances for use for industrial purposes in large towns.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

PRIVATELY OWNED WAGONS.

Sir,—A paragraph in your issue last week claims that privately owned wagons are more efficiently maintained because, out of 6676 coupling failures last year, 4139 corresponded to 700,000 railway owned wagons and only 2537 to private trucks.

This deduction, however, overlooks the fact that the railway owned wagons make a much greater number of journeys. Leaving aside some 250,000 special types, the railway companies possess about 450,000 ordinary wagons for general traffic purposes. The normal routine of the latter is that, a wagon loaded, say, at Manchester on Monday, arrives at a London goods shed during the night, and is unloaded on Tuesday morning. In the afternoon it is loaded again for, say, Bristol, where it is unloaded on Wednesday morning, and loaded up for Birmingham again the same afternoon, and so on. These railway owned wagons are thus making almost a loaded trip a day, against the privately owned wagon's record of only three trips a month. Consequently, in relation to the work they do, the failure of the couplings of railway owned wagons is much less than that of privately owned trucks.

The paragraph in question also suggests that its author misunderstands, or misconstrues, the ideas and intentions of "those who would like to see the privately owned wagon eliminated." Apparently he fears that if the trucks were placed under the single control of the railway companies the private owners would lose their interest and profit in them. But nothing of the sort would occur. Someone must provide the trucks, and someone must obtain interest and profit on them, and it does not matter in the least whether he calls himself a private owner or a railway shareholder.

The solution of the trouble is not really a question of "ownership," but of placing the wagons under a single control, in order to secure their more systematic, efficient, and economical distribution. The heavy economies in shunting, light mileage and other working expenses would not only enable the private owners to earn a better interest on their trucks, but also secure for them a substantial reduction in rates, as well as eliminate the costly stoppages of collieries which frequently occur through so-called "shortage" of trucks.

In regard to the interest, the following will illustrate what will happen. On coal coming to London the railways now collect, say, 12s. a ton, and the private owner collects 2s. a ton "wagon-hire" from traders and the public. The latter charge is made up, roughly, as under:—Interest and profit, 1s.; supervision and control, 6d.; repairs, &c., 6d. But when the railway companies take over the control of the private trucks they will collect the railway owned wagon rate of 14s. a ton, which includes "wagon-hire." This will mean a big increase in their receipts. The companies will hand the 1s. interest back to the private owner and will retain the other two items, as they will be responsible for meeting these charges. In practice they will require less staff—the private owners' wagon staff will also be completely eliminated—than at present to control the wagons, and therefore the whole of the 6d. will be saved. The repairs bill will also be reduced owing to the elimination of shunting and light mileage, and consequently they will be able to pay the private owner a better interest than 1s.

The simplest way is to give the private owner a railway certificate for the book value of his trucks, carrying a higher interest than he obtains to-day, and to return 75 per cent. of the savings in operating expenses to the collieries and other industries by way of a reduction in rates. In addition, colliery owners would make heavy savings through avoiding stoppages. There is thus no reason why the present private owners and wagon builders cannot continue to provide all the trucks for mineral traffic. Under these conditions their financial and other advantages would be much greater than to-day.

London, July 20th. E. R. B. Roberts.

THE EFFICIENCY OF STEAM NOZZLES.

Sir,—If an "energy" efficiency of any practical utility is to be attributed to a turbine nozzle, this must be the square of the velocity coefficient. Corresponding to this there is what may be termed an "effective" kinetic energy of flow, and it is this effective kinetic energy which must be used in any precise discussion of turbine problems on an energy basis.

As the Reports of the Nozzles Committee show, it is this effective kinetic energy which is referred to whenever the term is used there. This procedure is correct, since two jets communicating the same drive to a wheel may differ with respect to their true kinetic energies, but, other things being equal, must have the same "effective" kinetic energies. H. M. Martin,

Member of the Nozzles Research Committee.

Croydon, July 21st.

[In its first Report—"Proceedings," Inst. Mech. E., 1923, Vol. I., page 3—the Committee defined the energy coefficient or efficiency of a nozzle as "the relation between the energy due to the actual velocity of the steam as it leaves the nozzle and the energy theoretically due to the adiabatic expansion of the steam." We would be glad if Mr. Martin would state whether this definition is to be adhered to or whether we are to substitute for "the energy due to the actual velocity of the steam as it leaves the nozzle" words such as "the 'effective' kinetic energy as calculated from the mean velocity of efflux of the steam."—Ed. The E.]

LOCOMOTIVE TESTING PLANT.

Sir,—Might one who agrees completely with your most excellent leading article on "The Efficiency of Steam Nozzles" be allowed to disagree in part with your leading article on "Locomotive Testing Plants?"

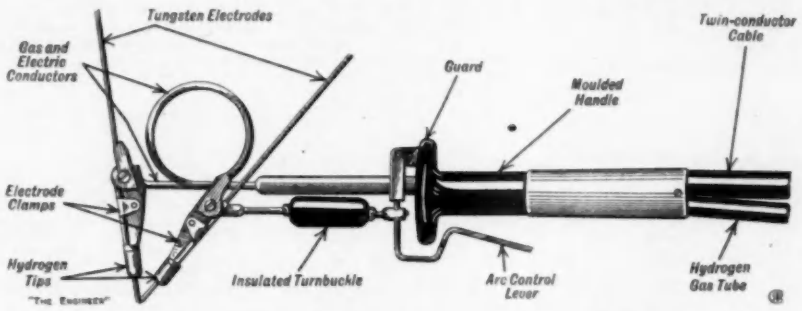
Broadly, my chief bone of contention is the last sentence of the latter article: "In the same way a locomotive testing plant must be operated under conditions which are not in all respects like those presented on the road in daily service; yet it enables researches to be carried out, and measurements to be made, which are practically impossible

upon the railway itself." Now, is it beyond the bounds of scientific attainment to measure the boiler loss and the cylinder losses in a steam locomotive, when it is actually in service on the track? Personally, I think it is not. I entirely agree with your advocacy of small-scale experiments for the determination of the wind resistance of locomotives in service. Dynamometer cars have already been developed satisfactorily for the measurement of the overall efficiency of locomotives. From the above would it not be possible to determine more useful information about a given type of steam locomotive than could be obtained from any testing plant such as those described in Mr. Gresley's paper, and further, would not the expenditure incurred for the tests be very considerably less?

July 20th. H. A. B.

Demonstration Workshop for Electric Tools.

In order to bring before industrial consumers the many applications of electricity to workshop practice, the Electricity Committee of the Manchester Corporation has recently opened a demonstration workshop at the Dickinson-street station, in which it is hoped, with the co-operation of the suppliers of the apparatus, to enable users of power to see actual machines at work under ordinary manufacturing conditions. The shop measures 75ft. by 15ft. by 13ft. high, and is well and uniformly lighted by fourteen 200-watt lamps, which give 10 foot-candles illumination on the work benches. The equipment is such that novel methods of manufacture, such as are now possible by electric welding, for example, can be shown. It includes a 125 kVA, three-phase, 6500/400-volt transformer, and three-pole, 300-ampère main oil switch, controlling all the workshop power circuits. These comprise three-pole air-break switch fuses of 250, 100 and 60 ampères, respectively, and three 30-ampère double-pole switch fuses. Nine 15-ampère, 230-volt, three-pin plugs are fitted at intervals round the walls and a continuous copper earthing strip makes it easy to earth apparatus at any point in the shop. A bench along one of the walls carries small portable appliances, a quenching tank, sink and hose pipe connectors, with a portable work bench, while a set of forge tools permit various heat-treatment processes to be carried out.



ATOMIC HYDROGEN ARC-WELDING ELECTRODE HOLDER

The first series of demonstrations was provided by the Metropolitan-Vickers Electrical Company, which lent for the occasion a single-operator D.C. arc welder; a transformer welder, an atomic hydrogen welder, and a continuous-feed welder, all of the latest design. We had an opportunity of witnessing, amongst other operations, the process of hand-welding, with the atomic hydrogen apparatus, and a continuous independent arc. By this process homogeneous ductile welds are possible on ferrous and non-ferrous metals and alloys. A single-phase A.C. arc is maintained between adjustable tungsten electrodes, while hydrogen gas is supplied to the arc round the electrodes. It is claimed that the hydrogen molecules are broken into atoms by the intense heat and, in recombining outside of the arc, heat is liberated far in excess of that obtainable by any gas flame alone. This heat is used to fuse the metals to be joined and results in high welding speeds. Where additional metal is required, a filler rod may be fused into the job. Hydrogen being a reducing agent, its use prevents the formation of oxides and a smooth weld results.

A typical electrode holder is illustrated herewith. It consists of an insulated handle with heat barrier and two electrode clamps, one of which is movable by means of a grip lever. The two tungsten electrodes are adjustable in these clamps. There is an annular opening in each electrode clamp, through which the hydrogen flows to the arc. The twin-conductor cable carrying the electrode current, and the gas tube carrying the hydrogen, both enter the handle of the electrode holder. In the handle, forming an insulated manifold, the gas is introduced into the two tubular conductors which lead to the electrode clamps. These tubular conductors are insulated from each other and from earth by a protected covering extending out to the loop. The maximum voltage on the electrodes is that corresponding to the voltage drop across the arc, *i.e.*, 60–90 volts.

A continuous-feeding welding equipment which was also being demonstrated provides bare electrode wire, which is fed from a reel by means of a small motor under the control of the operator, the principal advantages being increased speed of welding and the saving in wastage of electrodes as there are no ends to be discarded.

When the existence of this workshop becomes better known, it is hoped that industrial users will take full advantage of the facilities provided and indicate to the Electricity Department any special applications which may be profitably investigated.

American Engineering News.

Industrial Research in America.

Recent annual reports of various American organisations serve to call attention to the vast amount of research work being undertaken by scientific and commercial organisations for purposes of economic development. This kind of work may be classed as follows. First, the studies undertaken by Government bodies, such as the Bureau of Standards, Bureau of Mines, Bureau of Public Roads, and also the Highway Departments of the several States. Then come various scientific societies, such as the American Society of Civil Engineers, the Railway Engineering Association, the Waterworks Association and the Society for Testing Materials. Next may be classed the laboratory work—often very extensive—of the numerous universities and engineering colleges. Then there are the commercial associations undertaking research work in the interests of specific industries. Examples of these are the Portland Cement Association, the Gravel and Broken Stone Associations, Paving Brick Association, Wood-preserving Association, and innumerable others. As a rule, their work is really scientific and thorough, and is in the hands of engineers, chemists and others of high qualification and experience, and of national reputation. The fact that their scope is confined to some particular line of industry, which may even be competitive with other industries, does not affect or influence the scientific value of their work. In fact, these industrial research organisations are, in many cases, able to induce men of high rank in Government service to enter their employ, owing to the high salaries that can be paid in contrast with the notoriously low pay in Government departments. Finally, there are the private research forces of some large firms or companies, such as several of the large steel concerns; but, obviously, only very large and wealthy establishments can afford laboratory forces and equipment adequate for really scientific investigation.

Locomotives of 280 Tons Weight.

The largest and most powerful engines of normal type ever built—exclusive of some monster locomotives of the "Mallet" type—are said to be a group of forty engines for heavy coal, ore and goods service on the Chesapeake and Ohio Railway. They are of the 2–10–4 class, only a two-wheel bogie being needed under the short front end, while the long fire-box is carried by a four-wheel bogie having a geared booster engine. Nickel steel is used for the boiler and main frames in order to reduce the weight. The tender, which is very large, is mounted on six-wheel bogies, and the engine which operates the mechanical stoker is placed under its footplate. With 185 tons on the driving wheels the engine weight is 280 tons, to which the tender adds 200 tons. The connecting-rods drive direct upon two axles by means of tandem rods in line with them, and taking the place of the usual coupling rods between these axles. The leading dimensions and particulars are as follows:—

Cylinders	29in. by 34in.
Driving wheels	5ft. 9in.
Driving wheel base	24ft. 4in.
Engine wheel base	49ft. 3in.
Total wheel base	99ft. 6in.
Boiler diameter	8ft. 4in.
Boiler pressure	260 lb.
Tubes, length	21ft.
Fire-box	13½ft. by 9ft.
Grate area	122 square feet
Heating surface	6635 square feet
Superheating surface	3030 square feet
Tractive force	91,584 lb.
Tractive force with booster	106,584 lb.
Fuel	Soft coal
Coal on tender	30 tons
Water on tender	23,500 gallons

Dock Railways and Cranes.

A recent report of the American Association of Port Authorities concludes that, for American ports, the loading and unloading of cargo is done more efficiently by ships' gear than by dock cranes. While in Europe such crane equipment is highly useful in handling barged cargo, the use of barges is relatively small here, besides which the revolving crane is slower than the ships' gear. With modern steamers, the increased efficiency of the gear and the greater length of jib or cargo boom makes this method superior to cargo crane handling in speed, efficiency, and economy. For handling miscellaneous cargo at the dock and transit shed, the most suitable equipment for both ocean and inland ports consists of light tractors, trailer trucks and various types of mechanical conveyors, with locomotive cranes where heavier equipment is required. For very heavy lifting, floating cranes of 75 tons or greater capacity are considered preferable to shear legs or fixed derricks on the score of mobility. Where much cargo is handled directly between ships and railway cars, a width of 32ft. between the water side and the dock shed is recommended, accommodating two lines of railway, the inner line mainly for shunting, although both lines may at times be used for cars being loaded or unloaded in order to expedite the work. The rails should be level with the dock floor, as depressed tracks hinder the work by requiring temporary bridges across them for trucking directly between ship and shed. If locomotive cranes are to be operated on the ship side track, the tracks must be spaced 19ft. instead of 12ft. between centres, and the width of wharf or quay correspondingly increased to 39ft. With lighter service and only one railway line, a width of 20ft. will suffice, and is advisable also for trucking where there is no railway, except a 4ft. width is sufficient where much cargo is handled directly by ships' gear between the transit shed and the ship.

Nickel-clad Steel Plate.

A recent development in special steel products in the United States is the successful manufacture of steel plates up to ½in. thick, having one side coated with nickel, which is rolled on so as to be integral with the steel. The nickel represents about 10 per cent. of the total weight and the finish is similar to that of hot-rolled plate. While thin plate has been made in this way for some time and used for moulds and cooking utensils, it did not compete well with nickel-plated steel, or non-corrosive alloys. The new product will meet a demand for massive containers or vessels with special corrosion-resisting properties, such containers as are now made of steel shells lined or coated with nickel or similar metal or alloys. With the heavy weights of such vessels, solid plates of alloy metal are not economical, while pressures and convenience of working make linings or coatings more or less unsatisfactory. It is these conditions which will be met by the new so-called "nickel-clad" steel. One of the first commercial uses was in the manufacture of a railway tank car, or tank wagon, of 8000 gallons capacity, the plates being about 32ft. by 7½ft. In the manufacture, relatively thick sections of steel and nickel are placed in close contact, heated to a high degree and rolled to form the finished plate, the bonding of the metals being based upon the property of nickel which causes it to combine or alloy with steel at high temperatures, and thus form a solid or integral connection, with the nickel as a relatively thin skin or surface. In ultimate strength the nickel-clad steel has a somewhat higher figure than plain steel plate of the same thickness. It can be bent and folded without causing any separation of the nickel from the steel. Plates 8ft. wide and 500ft. long, ⅛in. to ½in. thick, have been rolled. Hot stamping, pressing, flanging and welding can be done in ordinary methods, as well as cold bending, shearing, forming, flanging and drilling.

HEAVIER RAILS ON MAIN LINES.

Some three years ago, says the *South African Engineer*, the Railway Board adopted a policy of increasing the axle load over the permanent way from 18 to 22 English tons, to be put into operation as soon as the track could be sufficiently strengthened. At that time the standard rail on main lines was the 80 lb. British standard section.

Investigations showed that this rail was capable of carrying an axle load appreciably greater than 18 tons, but that the joint—the chief source of weakness in all railway track—would prove troublesome and expensive. The surface of contact between the fish-plate and rail becomes worn, fish-plates become distorted and break, and the ends of the rail become hammered or dipped, thereby necessitating the removal of otherwise sound rails because of the bad riding of rolling stock. It was therefore realised that if the axle loads were to be increased the joints would have to be strengthened by designing a deeper rail and sturdier fish-plate.

During recent years the Administration has spent about half a million sterling on cast iron chairs and tapered steel keys for use on main lines, and the question arose as to whether any heavier rail could be so designed as to permit of the use of these fittings being continued, more especially as the sole plates in service prior to the introduction of cast iron chairs could again be used on the branch lines where the released 80 lb. rail would be laid.

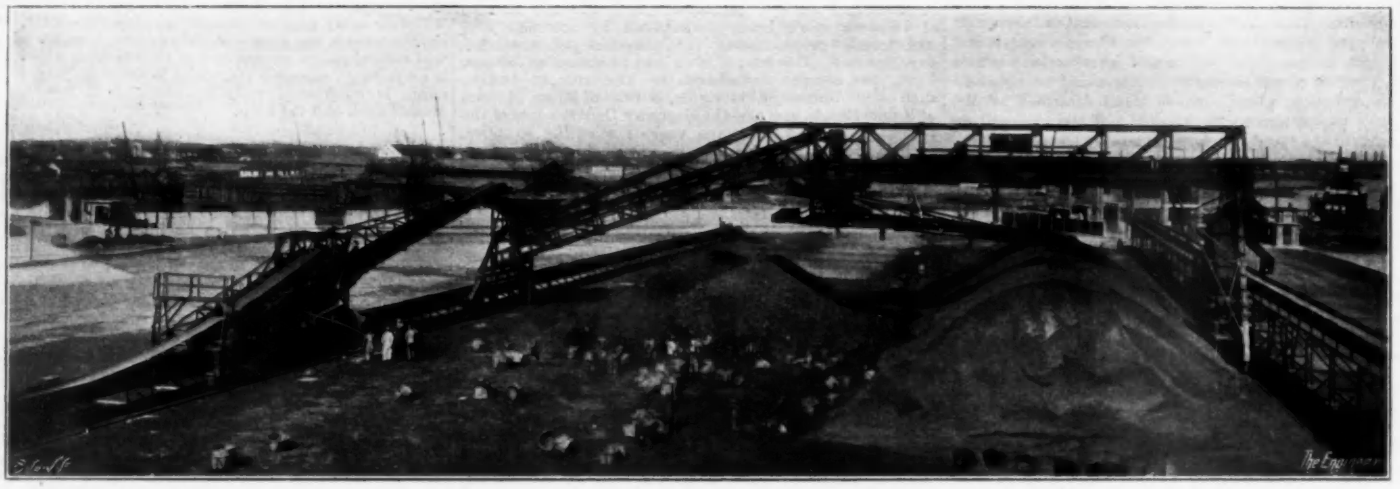
Another aspect that had to be borne in mind concerned the effects on rails of electrification and climate. In this connection it was, in 1926, found that on the sharper curves of the electrified portion of the Natal main line the 80 lb. British standard section developed a horizontal crack in the web just above the flange above sleepers. This condition served to show where the rail was weakest, and indicated the excessive lateral thrusts of the electric units. Since then a number of rails in sharp curves of steam sections, principally in damp localities or the neighbourhood of the sea, has been found with corrosion-fatigue cracks. These occur in the same parts of the rail as did those on the electrified portion of the Natal main line. This is attributed to the gradual wearing down of the metal by alternations of stress and corrosion due to moist and chemically active air and soil, but the development of the condition is so gradual as to be comparatively innocuous. The 85 lb. S.A.R. rail, which was designed to withstand the lateral thrusts of electric units, also proved eminently suitable to combat the corrosion-fatigue cracks, and was recently used in the relaying of the line over the Montagu Pass, near Oudtshoorn.

Taking all the factors noted in the foregoing paragraphs into consideration, the 96 lb. S.A.R. rail section was designed and adopted. Fifty track miles were ordered and placed in the Natal main line last year, while it is the intention to lay a further 250 miles on the various systems during the present year, it being realised that the sooner complete stretches of main line are relaid the sooner will it be possible to derive the full benefit of the improvement.

From September 12th to 27th next an International Foundry Exhibition and Congress, authorised by the International Committee of the Foundry Technical Associations, will take place in Milan. Inquiries should be addressed to Esposizione e Congresso Internazionali di Fonderia, Milano (102), Via Verdi, 11.

A BRITISH COAL-HANDLING PLANT NEAR SHANGHAI

THE MITCHELL CONVEYOR AND TRANSPORTER COMPANY, LTD., LONDON, ENGINEERS



A Coaling Plant in China.

A PLANT of rather unusual interest for the handling of coal, for its assortment and for its distribution has recently been completed near Shanghai, and is the subject of our Supplement and several other illustrations this week. It has been installed for the Kailan Mining Administration, the great coal-mining business of Northern China at Za Whei Kong, slightly upstream from Shanghai on the Whangpoo River and, consequently, commands one of the most industrial districts of China. In China, the favourite means of transport is water carriage, and the coaling plant has, therefore, been laid out especially to cater for that type of traffic; but it is also quite convenient for the distribution by road of the coal which it handles. The whole of this installation has been put in by the Mitchell Conveyor and Transporter Company, Ltd., of 45, Holborn Viaduct, London, E.C. 1.

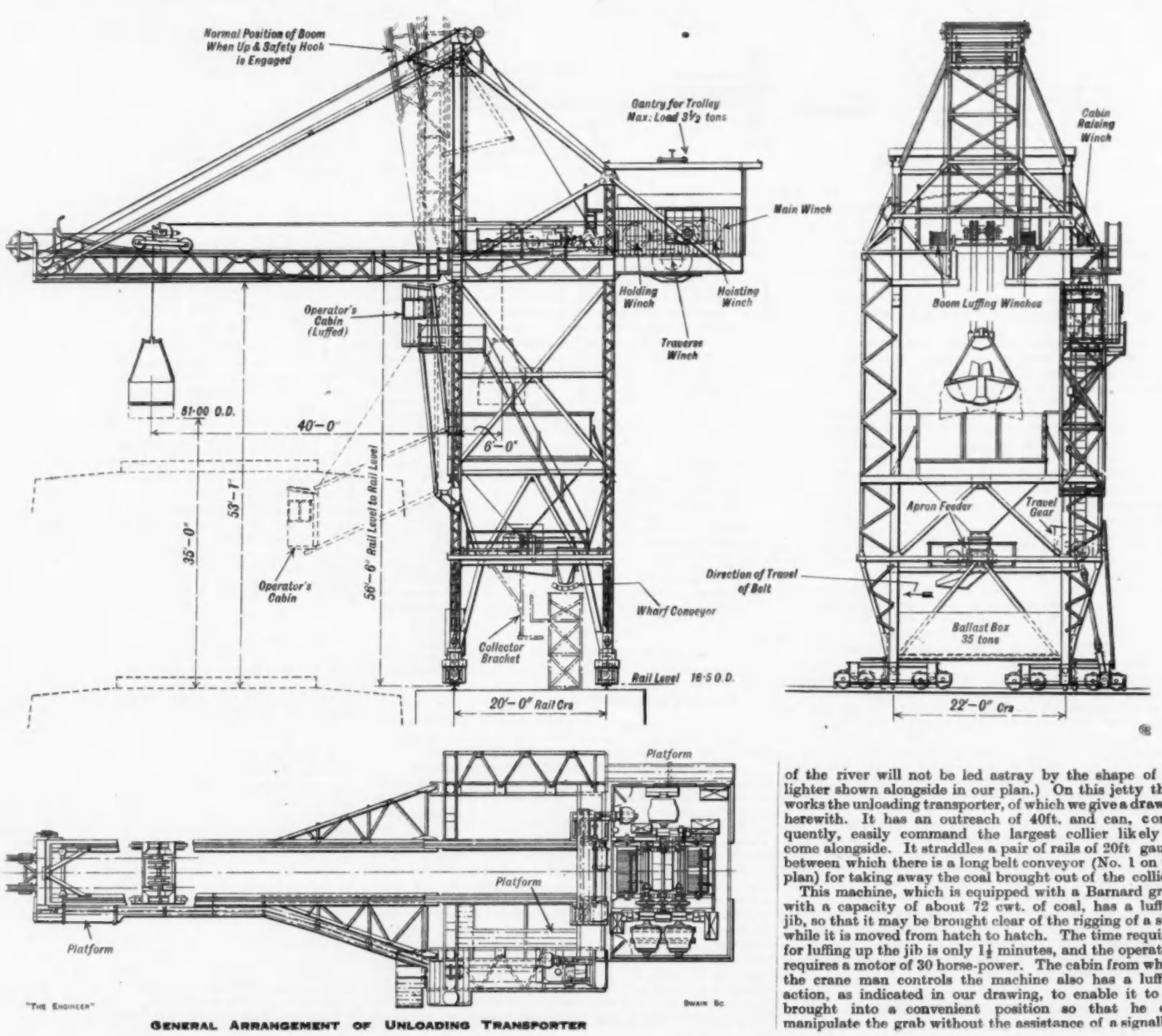
Some idea of the extent of the plant may be derived from the panoramic views in our Supplement, and herewith, while the plan view indicates that the site is roughly 800ft. by 500ft. The machinery is capable of dealing with coal at the rate of 300 tons an hour.

The coal arrives from Kailan in ocean-going steamers, which are berthed alongside a special wharf, at which they are unloaded as fast as possible, so as to release them for a return voyage. The coal is sorted, put into stock, and reloaded, either into local junks or lorries, according to market demands.

In broad outline, the plant may be divided up into several distinct sections, each of which we illustrate. There is the grab on the wharf for unloading the colliers and putting the coal on to a conveyor system, which takes it to a screening plant. There is a system of conveyors which reach from the screening plant over the whole of the site, and are supplemented by transverse travelling conveyors for the even distribution of the coal. Finally, there are two means of re-issuing the coal. A grab transporter, which commands the main storage ground, and a caterpillar grab, to go round the outside storage space and send back coal to the issuing transporter by way of the conveyor belts.

The jetty, as will be seen from the key plan, stands well in front of the bund, so that there is ample room behind for the accommodation of lighters and junks taking away small consignments of coal. (Those familar with the craft of the river will not be led astray by the shape of the lighter shown alongside in our plan.) On this jetty there works the unloading transporter, of which we give a drawing herewith. It has an outreach of 40ft. and can, consequently, easily command the largest collier likely to come alongside. It straddles a pair of rails of 20ft gauge, between which there is a long belt conveyor (No. 1 on the plan) for taking away the coal brought out of the colliers.

This machine, which is equipped with a Barnard grab, with a capacity of about 72 cwt. of coal, has a luffing jib, so that it may be brought clear of the rigging of a ship while it is moved from hatch to hatch. The time required for luffing up the jib is only 1¼ minutes, and the operation requires a motor of 30 horse-power. The cabin from which the crane man controls the machine also has a luffing action, as indicated in our drawing, to enable it to be brought into a convenient position so that he can manipulate the grab without the assistance of a signaller.



GENERAL ARRANGEMENT OF UNLOADING TRANSPORTER

The winches are all arranged on a cantilever structure at the rear of the tower and, consequently, counterbalance the weight of the jib. There are two motors of 130 horse-power each running at from 450 to 675 revolutions per minute for the grab, another of 130 horse-power for traversing, one of 60 horse-power for travelling, arranged just above the portal, a 30 horse-power main luffing motor, a 15 horse-power motor for luffing the cabin, and a 3 horse-power for feeding the coal from the hopper on to the conveyor. All these motors were made by the General Electric Company.

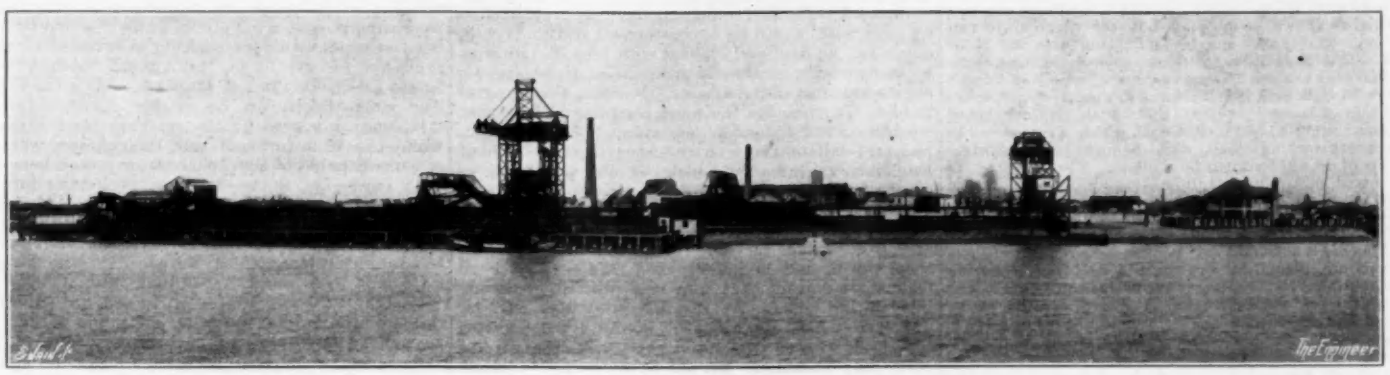
The speeds of operation are: Hoisting, 465ft. per minute; lowering the grab empty, 700ft. per minute; traversing, 585ft. per minute, and travelling, 100ft. per minute.

The coal grabbed out of the ship is dumped into a hopper in the tower of the unloading machine, and is fed by an apron plate feeder on to a belt conveyor, which runs along the length of the wharf. This conveyor has a capacity of 300 tons an hour, and passes over a weighing machine, so that the amount of coal discharged may be recorded. At the end of the wharf the conveyor rises to command another, transverse, conveyor, which goes ashore over a bridge. The coal is transferred from one conveyor to the other by a chute, which has an alternative opening, so that the coal may be delivered directly into a lighter lying alongside. The wharf conveyor is 415ft. long and is driven by a 20 horse-power motor, while the bridge conveyor is 165ft. long and also has a 20 horse-power motor.

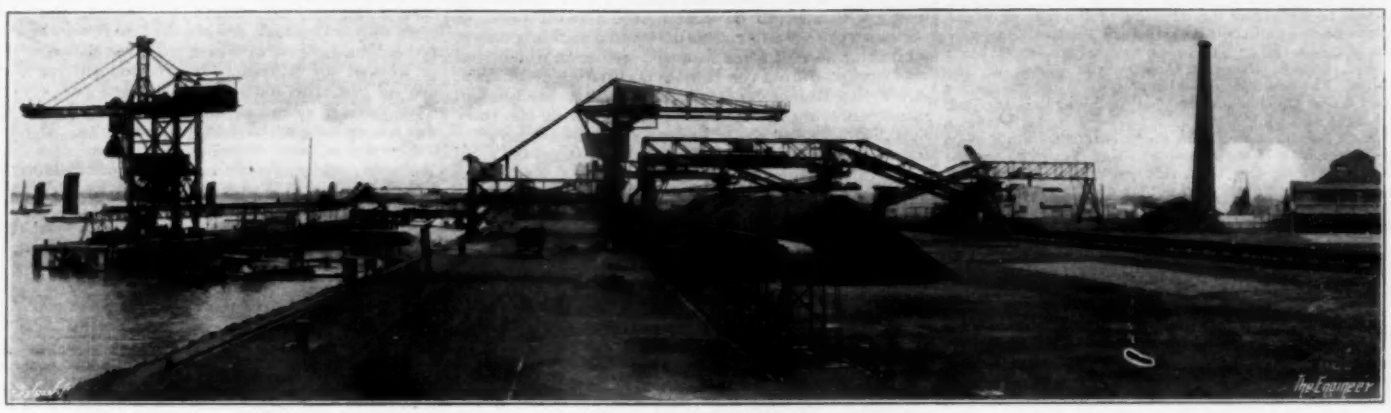
The bridge conveyor delivers the coal to a screening house, where the screening is done on three parallel conveyors, each capable of dealing with 100 tons an hour. They are 2ft. 6in. long by 4ft. wide and perforated with ¾in. holes to give an undersize of ¾in., or less, and lump coal above that size. Picking troughs are arranged down the centre of each screen to permit the coal to be cleaned by hand. The shale and other dross picked out is collected at the end of the screens and carried away by a 20in. conveyor, marked No. 23 in the plan, to a small elevated hopper near the waterside. The shale can be dumped from this hopper either into lighters on the river or on to a heap on the ground, whence it can be carted away. The screens are each provided with a door in the upper, or screening, tray, so that, if desired, the whole of the coal can be passed through the house without screening, the screens then merely acting as conveyors.

In ordinary running, the lump and the small coal are delivered separately on to two short collector belts, which deliver on to two conveyors, marked No. 5 and No. 6, which run across the end of the storage ground. Each of these conveyors is equipped with a weighing machine, to enable the proportion of large to small coal being stored to be determined.

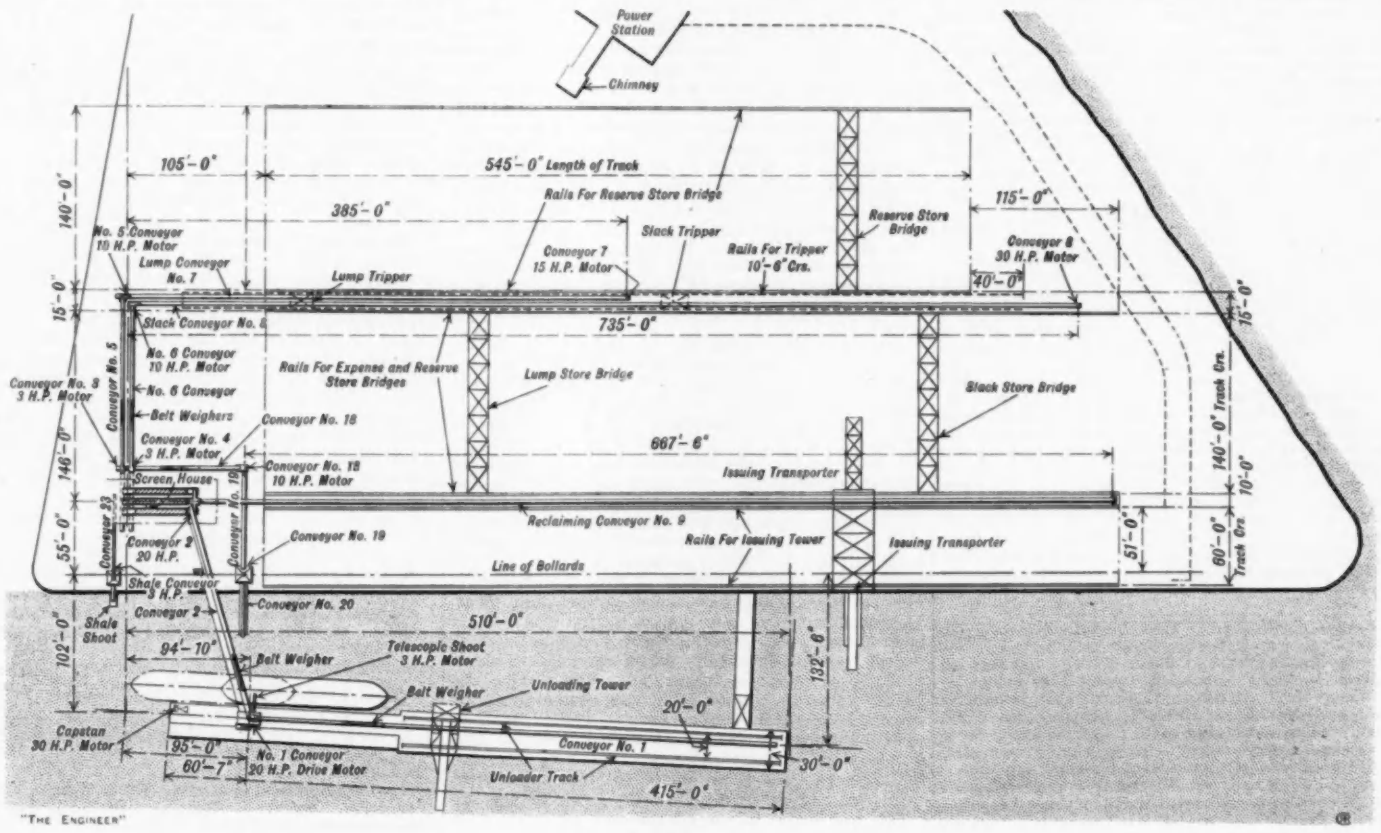
It may occasionally be desired to issue graded coal to



GENERAL VIEW OF THE COAL HANDLING PLANT AT ZA WHEI KONG FROM THE RIVER



FROM LEFT TO RIGHT:—UNLOADING GRAB, RE-ISSUING GRAB AND CONVEYOR, AND TWO STACKING CONVEYORS



KEY PLAN OF COAL HANDLING PLANT AND STORAGE GROUND

lighters as the collier is being discharged. A second by-pass in the system is, therefore, provided immediately after the screening house, in the form of the conveyors Nos. 18, 19 and 20, which are 30in. wide. There is a weighing machine on the first of these conveyors, and the loading conveyor is mounted on a tower in such a manner that it can be luffed and has a telescopic end, so that coal can be loaded at any state of the tide with a minimum of breakage.

For storage purposes the ground is divided into two sections, as shown in the plan, between which there run two long conveyors—one is 735ft. long and the other 385ft. One is devoted to the conveyance of lump coal, and the other to slack. These two conveyors—Nos. 7 and 8—have 30 H.P. and 15 H.P. motors respectively. On the river side of these conveyors, there is an area capable of accommodating 32,500 tons of coal, which is considered as the general working stock, while behind the conveyors a reserve of 26,500 tons can be stacked.

The coal, naturally, has to be stacked to a considerable height, but, on account of the length of the conveyors, they could not be conveniently raised sufficiently to command the heap. Instead, they are kept at a low level and the coal is taken off and raised to the requisite height by separate machines and then distributed over the storage ground by three travelling bridge conveyors. One of the tippers and conveyors is well illustrated at the head of this article.

The broad principle of the process of distribution is to pass the long main belt over a tripper—there are two trippers, one for each belt—to pick up the coal from the tripper on a short inclined conveyor and dump it into a hopper at the end of the travelling bridge. It is then taken across the bridge and spread on the dump by a radial arm.

As will be seen from the drawing of the tripper in our Supplement, the main belt is carried up a set of idlers to a height of about 15ft. The other belt, which is not being unloaded, passes straight through the portal of the machine. The belt is doubled back on itself and discharges its load on to another inclined belt, which raises the coal to a height of about 27ft. This conveyor is carried on a jib, which can be slewed to a slight extent by hand gear, and is driven by a 15 horse-power motor. It will be noticed that the sides of the conveyor are protected by wind boards to prevent dust being blown off and causing a nuisance.

The coal is dumped into the hopper of one of the travelling bridges, which, as will be seen from the drawing and the engravings, has what might be described as a "dog's leg" shape. These bridges have a span of 140ft. and are equipped with 36in. belts. The coal is carried up the inclined leg of the bridge and tripped into a hopper feeding another conveyor carried by a depending radial jib. This jib can be slewed round to command the whole of the area under the bridge and can also be dipped so as to reduce the free fall of the coal as far as possible and prevent unnecessary breakage. There is a continuation of the bridge conveyor which may be used to carry the coal to shoots on its far side. One of the shoots feeds the reclaiming conveyor No. 9, and is used when getting coal which has not been screened before stocking. It will be seen that the conveyor delivers directly to the screening house. The other shoot may be connected with the rear of the "issuing tower," which we are about to describe, when the coal can be taken through the process of screening and re-shipped directly by the tower without being put on to the storage ground, the difference between this system and that of shipping by the small conveyor No. 20 being that the issuing tower is mobile and can command a larger vessel.

The issuing tower, as will be seen from the drawing in our Supplement, is a cantilever structure running on rails near the river front, and commands the main storage yard. The cantilever has an outreach of 65ft. and is equipped with a grab of 2½ tons maximum capacity. The grab itself weighs 2½ tons. The speed of hoisting is 270ft. per minute, and gives an average output of 150 tons of coal an hour. The coal, as it is grabbed, is dumped into a hopper in the main tower of the machine, and goes through a weighing machine to a belt conveyor spanning the track towards the riverside. This belt is 30in. wide and runs at 320ft. per minute. Reaching out over the water there is a jib which carries a loading conveyor of the same capacity. This conveyor has a telescopic end, which can be extended 15ft. and gives a maximum outreach of 60ft. The idlers on this telescopic section are connected by means of a system of "lazy tong" links, so that their pitch is adapted to the length of extension. It can also be luffed up and down to suit the height of the tide and save the breakage of coal as it is fed to the lighter. There is also a chute from the hopper into which the grab delivers, that may be used to supply two small platform-weighing machines for the issue of coal to carts in lots of 2 cwt.

The coal, which is put into the reserve store behind the issuing transporter, may be run-of-mine, lump, or slack. When it is necessary to fall back on this reserve, a steam grab on caterpillar tracks is brought into service. It is capable of handling about 150 tons an hour and dumps the coal into the hopper of one of the transverse bridge conveyors. The coal can then be sent to the screen house for cleaning, or shipped away through the issuing tower.

It is significant that the London, Midland and Scottish Company should have found it advisable to reorganise and strengthen its commercial department, especially on the passenger side. Hitherto, all passenger traffic matters, except the operation of the trains, have been under the "general superintendent (passenger commercial)," who has been subject to the "chief general superintendent," and therein has been different from the chief goods manager, who holds rank with the chief general superintendent. From October 1st the passenger business is to be dealt with by, as now, Mr. Ashton Davies, but he will be then known as the passenger manager, and his department will be strengthened by various district passenger managers and district passenger and goods managers—the latter will continue to look after goods business. It is important to note that the official announcement says that the district officers are to be given the widest possible powers in their respective districts, and thus able to see that the public requirements are fully met. This appears to be a step towards decentralisation.

Literature.

Wealden Iron. By ERNEST STRAKER. London: G. Bell and Sons, Ltd. 1931. Price 15s. net.

THIS is a book which must have involved an immensity of research and which could only have been undertaken by one with a strong archæological bent. It will, doubtless, be read and studied with profound interest by many—whether they be antiquaries, archæologists, engineers, metallurgists, or, indeed, the general public. It embodies the most complete history that we have come across in one volume, of the origin, rise and fall of the iron industry in the South of England—an industry which, at one time, was of great prominence in the land.

The book is divided into two sections: (I.) Historical and Explanatory, and (II.) Topographical and Descriptive Survey. From the first we learn that, during the last few years, evidence has been fast accumulating that iron was smelted in Sussex in neolithic times. At Playden, near Rye, Mr. H. J. Cheney has, we are told, found typical cinder associated with very primitive pottery, while at several sites near Hastings, Mr. J. E. Ray has gathered flint implements at "bloomery" sites; that is to say, sites of works that produced iron by the "direct" process. In any case, the industry was sufficiently well established to have attracted the attention of Cæsar on the occasion of his first raid into this country, while the sites of some hundred works at which iron was worked during the Roman occupation are known. After the Romans left, it, apparently, declined in importance, though it still remained during the Dark and Middle Ages "as a limited and almost domestic industry." Then, during Tudor times, about the close of the fifteenth century, "after, possibly, 2000 years of small things," the introduction of a new smelting process caused a "meteoric rise in less then eighty years to a maximum importance," and, thereafter, there was a gradual decline ending in complete extinction rather more than 300 years after the rise began. To discuss the history and to give information regarding the places in the South-East of England where iron is known to have been worked has been the author's aim, and he has carried out his task with commendable thoroughness, having regard to the area over which the available particulars were scattered. Nor has he relied solely upon the discoveries of others, for his own investigations have brought many new facts to light and have paved the way towards the making of additional discoveries.

The ore from which the iron was made was all obtained from the Weald. The Wealden beds consist of clays or sands, the latter hardening in part to form sandstone. It is considered by geologists, Mr. Straker explains, that the material was brought down by a large river from an Atlantic Continent in the south or south-west, of which the granite of the West Country and of Ireland are the only relics to-day. This river flowed into a shallow inland lake with an ex-current river emerging from its southern side and running south-west through France. The silt brought down by the river contained a considerable percentage of iron, and the lake water was strongly charged witn that metal. This iron could have been deposited as a sediment, but it seems probable that a great deal was formed by chemical precipitation caused by the absorption by plants of carbon dioxide. Some authorities consider that much of the bog-ore was deposited by iron bacteria. Whatever their origin, the fact remains that throughout the Weald there are vast deposits of iron ore, the existence of which was known to very early inhabitants of the Island.

Originally, the metal was produced from the ore in as primitive a way as that employed among savage races to-day, but in tracing a clear history of the production of iron, it should, Mr. Straker remarks, be remembered that there were two distinct methods of arriving at the desired result. In the earlier, or "direct" process, the apparatus was of the simplest kind, consisting only of a small furnace or hearth, and some form of blowing machine. Only rich ores were employed and the fuel was, invariably, charcoal. A lump, or "bloom," of malleable iron was directly obtained, and the ancient furnaces in which the direct process was carried on were designated *bloomeries*. The smelted metal was never in the fluid state. The author traces the evolution, from this early method to the second or "indirect" method in which molten metal is obtained. When water power began to be substituted for human labour in serving the bellows, the blast obtainable was greater and the size and height of the furnace were gradually increased, with the object of obtaining a greater output. This striving after greater production had, we are told, the unwanted effect—owing to the higher temperature obtained—of causing that portion of the ore which was longer in the furnace and subjected to a greater heat, to become fluid instead of remaining in the plastic state desired by the operator, so that he might hammer into a useful material. At first the molten portion was a waste product, but it was soon discovered how to convert this cast iron by further heating and working under the hammer into a malleable metal.

It was, Mr. Straker explains, owing to the introduction of this second method that the great expansion in the Wealden iron industry was made possible. We have not space to discuss further all that he tells us about these two processes and how the second eventually ousted the first, but must leave those of our readers who are interested to follow the author for themselves through his fascinating descriptions.

Although water power was not, in the earlier times, used for operating the bellows or other blast-producing means, a supply of water "seems to have been essential, either for drinking, or, what seems more probable, for use in the troughs or 'boshes,' such as one sees to-day in any forge for cooling the tools." The sites which can be readily distinguished as "bloomeries," were usually on very small streams, while the blast-furnaces and their forges were on streams capable of supplying water power, generally with bays—*i.e.*, dams—forming, or having formed, ponds. There is a chapter devoted to "Hammer-ponds and Power."

Thereafter, the author reviews, successively, in separate chapters, "The Furnace," "The Forge," "Cinders and Slags," "Mining and Ore," and "Fuel," afterwards passing on to deal with the products of the works, including guns, fire-backs, &c., as well as the questions of transport, finance, &c. We cannot, however, do more than just refer to these matters, to which the concluding portion of the first section of the book is devoted.

The second section is concerned with a topographical survey of a very large number of works. Particulars, more or less detailed, are given of no fewer than some 250 establishments at which iron was either produced or worked up or both. In treating this portion of his subject, the author has divided the area into river basins, since, as has been said above, water was a necessary adjunct to the ironworks. The basins followed are as follows:—The Eden and Lower Medway; Kent Water and Cansiron Stream; the Upper Medway; North Ashdown; East Ashdown; Teise; Rother—Upper, Middle and Lower; Brede and Tillingham; Asten; Ashburn; Cuckmere; Ouse—Uckfield River, Central or Maresfield, and Western; Adur, Arun and Western Rother and North River; Wey and Mole.

In giving the particulars of these numerous works—Bloomeries Furnaces or Forges—the author is careful to include in each case (1) the exact geographical position in degrees, minutes and seconds of longitude and latitude—he evidently does not intend that future generations shall have difficulty in fixing the sites—(2) the parish; (3) the distance from the nearest church; and (4) any place name or names associated with the establishments. The information given varies in length and detail, and in reading the book we have often wished that further data were, in some cases, available; but all that is given is highly informatory. The subject matter is made all the more interesting by the inclusion of numerous half-tone reproductions of photographs, some of which might, with advantage, perhaps, have been of larger size, and of a series of most excellent maps prepared from, and of the same scale as, the ½in. to the mile Ordnance Survey. On these maps are noted the positions of the works, bloomeries, furnaces and forges, each indicated by a separate symbol, the Roman-operated works having their own special sign.

The volume is completed by the inclusion, at the beginning, of a glossary of certain words, which occur in the records and place names, and which have a local or specialisied meaning, and, at the end, of two indices, one of parishes and the other of general matters. From the glossary it may be learned that a "bay" means a dam for holding up a stream to form a pond, and not the pond itself; that "to cole" means to convert wood into charcoal; that a "brook" meant a meadow abutting on a stream liable to flooding, and not a stream; that a "sow" or "sowe" meant a long piece of cast iron made by running the molten contents of the furnace into a sand mould, while a "pig" meant a small "sow," or branches from the "mother sow"; and that "mine" meant the ore itself, and not the pit. A word may be added in praise of the general index.

BOOKS RECEIVED.

Bronze und Rotguss. Berlin: V.D.I. Verlag G.m.b.H., Dorotheenstrasse 40, N.W. 7. Price 7 marks.

Surveying Manual. Second edition. By H. C. Ives. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 11s. net.

The Light Aeroplane Manual. By F. D. Bradbrooke. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 10s. 6d. net.

Surveying from Air Photographs. By Captain M. Hotine, R.E. London: Constable and Co., Ltd., 10–12, Orange-street, W.C. 2. Price 30s. net.

Mining Electrical Engineering. By H. Cotton, M.B.E., D.Sc., &c. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 15s. net.

Engineering Geology. Fourth edition. By H. Ries, Ph.D., and T. L. Watson, Ph.D. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 25s. net.

The Modern Soap and Detergent Industry. Two volumes. Second edition. Vol. I., *Theory and Practice of Soap Making.* Vol. II., *The Manufacture of Special Soaps and Detergent Compositions.* By G. Martin, D.Sc., Ph.D., F.I.C. London: Crosby Lockwood and Son, Stationers' Hall-court, E.C. 4. Price 36s. per volume net.

Railway and Road Matters.

THE axle-load limits between Tonbridge and Hastings have been increased and heavier engines may now run over that section. The structure gauge limits in some tunnels have been enlarged, curvature at certain points improved, and the line re-ballasted.

THE political correspondent of *The Times* said, in the issue of that paper for July 14th, that, though it is hoped to complete the work of the Joint Committee which is considering the London Passenger Transport Bill before the summer recess, it is not proposed to bring the Bill before the House of Commons again until October. Since then—on Monday, the 20th—the Joint Committee has announced its decision to allow the Bill to proceed, subject to certain alterations.

WHEN an electrically-operated train from Epsom Downs was entering No. 17 platform line at London Bridge on Thursday, July 16th, it failed to be pulled up in time and collided with the buffer stops. Two compartments of the second coach from the front were damaged and there were a few cases of minor personal injuries. It having occurred to us that buffer stop collisions at London Bridge were very rare, especially in view of the frequent train service, we have looked through our file of accident reports as far back as 1900, and find that no such accident has been inquired into. On the other hand, there have been three collisions, of which one had fatal consequences.

ANSWERING a question on July 15th, Mr. Morrison said that he was informed by the London and North-Eastern Railway Company that it was actively considering the question of some developments at Liverpool-street Station and in the former Great Eastern Railway area, and that in the event of the London Passenger Transport Bill becoming law, it was anticipated that a scheme would be ready for submission to the Standing Joint Committee of the proposed Transport Board and the amalgamated railway companies which would be set up under the Bill to consider such proposals affecting their joint interests. The company added that, in the meanwhile, the work of preparing the scheme was not being held up.

IN a note in our Seven-day Journal on February 27th last it was mentioned that the London Underground Railway Company was seeking powers to extend the "Bakerloo" line from its southern terminus at Elephant and Castle to Camberwell Green, and on March 20th we announced that a "late Bill" had been deposited for that purpose, which includes a new station on the south-west corner of the Green. On the Bill coming up on July 13th, for third reading in the House of Lords, objection was taken to encroachment on a public open space. The railway company has now informed the Borough Council that it has decided to drop the proposal for a station on Camberwell Green, that another site next to the Green has been chosen and that the Bill will be altered and will go forward without delay.

THE intimation that the Railway Returns for 1930 have been issued as a Stationery Office publication, price 6s. 6d., prompts the remark that these Returns date back to the Act of 1868, which laid down the form in which the railway companies were to prepare their half-yearly reports and the particulars that were to appear therein. That form remained unaltered until the Railway Companies (Accounts and Returns) Act, 1911, was operative with the reports—made annual by that Act—for 1913. Considerably more information was then given, but it was all greatly enlarged when the Ministry of Transport was established and the Railway Returns of to-day not only give particulars of the capital, traffic, receipts, working expenses and operating results, but many of those particulars that appear in the Ministry's monthly railway statistics, such as ton-mileage figures, train loading, consumption of coal and oil, and, now, particulars of the road transport business.

IN our issue of June 12th, we referred to the fact that the 13th of last month saw the centenary of the opening of two branches of the Liverpool and Manchester Railway, the hundredth anniversary of which was celebrated on September 15th of last year. Those branches were originally the Bolton and Leigh and the Leigh and Kenyon railways: the former was intended only to connect the Manchester, Bury and Bolton Canal at Bolton, with the Leeds and Liverpool Canal at Leigh, whilst the latter was designed to connect Leigh with the Liverpool and Manchester Railway. On July 25th, there comes the centenary of the opening of the Warrington and Newton, which joined Warrington with the Liverpool and Manchester Railway at what is now known as Newton-le-Willows. This last line was later to become a connection of prime importance, as it was to be the northern end of the Grand Junction Railway, and thus connect Liverpool with Birmingham, and thence, by the London and Birmingham Railway, with London. Moreover, with the Wigan branch from Parkside to Wigan and the North Union from Wigan to Preston, it was to be part of the main line to the North.

THE Board of Trade export tables for the month of May show the value of the railway material sent overseas during the first five months of the present year to have been as follows, the corresponding figures for 1930 and 1929 are added in brackets:—Locomotives, £870,058 (£1,517,356, £1,292,764); rails, £488,852 (£1,038,284, £1,254,720); carriages, £733,510 (£731,894, £824,711); wagons, £618,031 (£1,400,309, £1,181,663); wheels and axles, £99,080 (£140,167, £183,507); tires and axles, £145,612 (£316,037, £232,950); chairs and metal sleepers, £149,415 (£349,420, £208,918); miscellaneous permanent way, £216,409 (£382,903, £474,054); total permanent way, £1,124,011 (£2,287,858, £2,420,516). The weight of the rails exported was 58,374 tons (118,003 tons, 149,623 tons), and of the chairs and metal sleepers, 20,340 tons (37,610 tons, 21,015 tons). During the month of May last the value of the locomotives shipped was £79,549, and included: The Argentine, £31,332; India, £13,113; Australia, £9500. For the same month rails to the value of £36,806 were exported and included: British West Africa, £15,225; Portuguese West Africa, £6849; the Argentine, £3342; New Zealand, £3099; Straits Settlements, £2583; Ceylon, £2436.

Notes and Memoranda.

IT is estimated that 70 per cent. of the energy used in the mining industry of Canada is supplied electrically, and that there are few industries which do not employ more than 50 per cent. of their requirements in the form of electricity.

IN the Makum coalfield of India, which is situated on the North-East frontier in Upper Assam, several seams are being worked which range in thickness from 4ft. to 60ft. Labour difficulties, however, are reported to be hampering operations.

AN extension had to be made to a seventeen-storey building in Atlanta, Ga., U.S.A., and tenders were asked for alternative designs. The *Engineering News-Record* says that tenders for the steel structure were, roughly, 90,000 dollars with bolted joints; 92,000 dollars with welded joints, and 93,000 dollars with riveted joints.

THE great new chimney stack at the Copper Cliff smelting works in Ontario, is 510ft. high and 45ft. in inside diameter at the top. It is 73ft. in outside diameter at the bottom, where the wall is 4ft. 6in. thick. At the top it is 17in. thick, not including the 4in. lining. The job required 15,600 tons of bricks and was completed in five months and four days.

IT is claimed that one of the largest carbon circuit breakers for electrical purposes, has been made by the Westinghouse Electric and Manufacturing Company of America. It is capable of opening a circuit of 48,000 ampères, D.C., at 600 volts, and is worked by solenoids, each of which is 7in. in diameter and capable of a pull of 3½ tons. There are twelve current-carrying brushes and their total closing pressure is over 6 tons.

IN the course of some remarks at the annual dinner of the South African Institution of Engineers, Mr. A. French, the President of the Chamber of Mines, said that the gold-mining industry of South Africa paid £282,682,000 in wages and salaries during the period from July 1st, 1910, to December 31st, 1930. In the same time £151,323,000 was expended on stores produced locally, and £102,321,000 on imported stores. The total expenditure was £537,000,000, and the value of the gold obtained £762,000,000.

ALTHOUGH untreated hemlock sleepers have, in America, the short life of four to eight years, as decay begins soon, especially in moist climate, the Northern Pacific Railway is having good results from creosoted hemlock sleepers, some of which have been in the track for twenty-one years, according to a paper read before the Pacific Railway Club by Paul McKay, assistant purchasing agent. These sleepers cost less than Douglas fir, but require a longer period of air seasoning, since they contain a much higher percentage of moisture. The preservative used consists of 80 per cent. creosote oil and 20 per cent. California fuel oil.

ACCORDING to the annual report of the Northern Coke Research Committee for 1930, its work has continued to expand and progress. Early in 1930 the Committee decided to make a financial appeal to coke manufacturers of the district who had not then contributed directly to the cost of the researches. The basis suggested was that of a levy at the rate of 5s. per 1000 tons per annum for three years, and it is gratifying, says the report, that this appeal has met with a considerable measure of success. The increased subscriptions thus received, together with the corresponding Government grant, have enabled the Committee to increase the staff of the laboratory by two members and, in addition, to purchase much-needed apparatus.

AN installation which has just been completed at the electricity showrooms of the Cardiff Corporation permits of the demonstration of a number of different types of water heaters at the same time, thus illustrating to prospective customers the characteristics and comparative working cost of each type. A steel frame work has been erected for the accommodation of the appliances, and a switchboard is fitted alongside it equipped with three heat control switches for the heaters and an ammeter with cost-per-hour readings. A feature of the installation is the ease with which the heaters being demonstrated can be changed for others. The adjustable framework can be adapted to equipment of any size, and all the essential water connections are readily detachable.

THE pressure produced on blowing electric fuse links has for some time been a subject of study by the Safety in Mines Research Board in collaboration with the British Electrical and Allied Industries Research Association, and some of the results have already been published in Research Board Papers Nos. 38, 39, and 52. Further work has been carried out to ascertain the effect of surrounding copper fuse links with different gaseous media at atmospheric and reduced pressures, and the results should have an important bearing on the construction of electric cut-outs and fuses. They are published in Safety in Mines Research Board Paper No. 67, "The Pressure Produced on Blowing Electric Fuse Links; the Effect of the Surrounding Atmosphere," by G. Allsop and P. B. Smith. The paper is on sale through H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, and copies are obtainable either directly or through any bookseller, price 6d. net.

ACCORDING to a paper given by Mr. E. H. Smythe before the Jubilee meeting of the Society of Chemical Industry, the following figures give an indication of the extent to which oil is now being used as a fuel in the shipping world. In 1914, the volume of tonnage using oil was 1,300,000. Last year, it had increased to 28,000,000 tons, or about 42 per cent. of the total world tonnage. The shipping of the world at present represents a gross tonnage of 69,000,000, and the proportion using coal exclusively is 58 per cent., compared with 89 per cent. of the total world tonnage of 45,000,000 in 1913. In 1930 steamers were launched representing 2,889,000 tons, of which only 700,000 tons were fitted for burning coal. Apart from these figures, which are concerned with the use of crude oil, the imports of motor spirit into this country alone amount to an average weekly figure of as much as 22,000,000 gallons, and the total value of the fuel oil imported reaches the large amount of nearly £40,000,000 a year.

Miscellanea.

IT is said that an old, abandoned, gold mine has been rediscovered in the Gwarda district of Rhodina, in which the ore runs as high as 57 dwt. per ton.

IT is proposed to construct a bridge across Umlaas Drift, near Durban, Natal, at a cost of some £45,000. The details of the design have not yet been settled.

AN oil refinery with a capacity of 15,000 barrels of oil a day is being erected by the British American Oil Company in Montreal. Its cost will exceed 2,000,000 dollars.

ON account of the low prices of metals both the Namaqua Copper Company's mine and the zinc plant at Broken Hill, in South Africa, have both been closed down. On the other hand, work is being pressed on on the completion of the equipment of the Roan Antelope copper mine.

IT appears that the great iron and steel works at Kuznetsk, on the foothills of the Altai Mountains, are nearing completion. They are being equipped with four batteries of coke ovens, four blast-furnaces, fifteen open-hearth furnaces and sundry rolling mills. The intended output is 1,200,000 tons of pig iron a year.

THE new copper refinery at Quebec has just been formally opened. It has a capacity of about 75,000 tons of copper a year, and is to be worked in conjunction with a wire and cable factory capable of producing 80,000,000 lb. of copper wire a year. It is said that the electrolytic vats of the refinery contain as much as 14,000,000 lb. of copper.

THE Natal Institute of Engineers is issuing an appeal to "the many throughout the Union and beyond, who have 'made good' by their adoption of the engineering or allied professions, to show their thankfulness in a practical manner by coming to the aid of future engineers in helping to provide the necessary equipment, it being borne in mind that our Natal University College is one of only three in the whole Union where facilities for engineering studies are available."

IT is announced from New York that the first of eight "seadromes" to be stationed on the Atlantic at intervals of 380 miles between the United States and England will be constructed off the east coast of America next spring. These seadromes will each have a 6-acre deck, 70ft. above the surface of the water. They will be buoyed by air tanks extending 40ft. below the surface. Ballistic tanks, filled with pig iron and giving the seadromes their stability, will extend 117ft. downwards.

THE official returns rendered to the Electricity Commissioners show that 776 million units of electricity were generated by authorised undertakers in Great Britian during the month of June, 1931, as compared with the finally revised figure of 709 million units in the corresponding month of 1930, or an increase of 9·4 per cent. During the first six months of 1931 up to the end of June, the total amount of electricity generated by authorised undertakers was 5630 million units, as compared with the finally revised figure of 5421 million units for the corresponding period of 1930, representing an increase of 3·8 per cent.

ACCORDING to the Report of the Geological Survey Board for 1930, Summary of Progress, Part I., satisfactory progress continues to be made in the study of the gravitational torsion balance and the magnetic balance as aids to the work of the Survey. During the year an Eötvös-Süss small torsion balance was acquired and a gravitational survey carried out in the Thrussington area of Leicestershire. Magnetic surveys were also carried out (1) on the Lornty Dyke, Blairgowrie, Perthshire, (2) at Portobello, Edinburgh, (3) at Groby, Leicestershire, and (4) at Pipewell, Northants. The report can be obtained from H.M. Stationery Office, price 2s. net.

THE new entrance to Gaefle Harbour, in Sweden, is expected to be completed in a few weeks. It is a good deal broader, deeper and straighter than the old one, and the biggest ocean cargo steamers will, when it is opened, be able to enter the harbour by day or by night. The reconstruction work has cost about Kr. 1,500,000. The Stora Kopparbergs Bergslags Aktiebolag, will, it is stated, import large quantities of coal *vid* the reconstructed port in August and September, using six or eight big ships of a size that previously was not able to enter the port. The small town of Norrtaelje, which lies some 60 kiloms. north-east of Stockholm, is also planning the enlargement and deepening of its harbour.

ACCORDING to a message from New York, the highest building in the world is to be the first home of practical television in the United States. On the eighty-fifth storey of the Empire State Building, which rises to a height of a thousand feet above Fifth-avenue, the National Broadcasting Company is installing a complete television equipment with a television antenna on top of the building's mooring mast, 1250ft. above the street level. The company's engineers believe that the operation of television at that height will help to overcome many of the difficulties previously encountered in visual broadcasting. Work in the studio will be begun as soon as an experimental licence can be obtained from the Federal Radio Commission.

FRANCE is no more favoured with her foreign trade than most other countries, and the returns for the first six months just published are distinctly discouraging. The imports were valued at 23,201 million francs, a decline of 3629 million francs as compared with the first half of 1930. This diminution was largely due to a depreciation of the values of raw and partly manufactured material, and also to a contraction of more than a million tons in the imports of coal. The French paid less for that material, and they also paid relatively less for much heavier purchases of foreign produce. To that extent the returns are in their favour. The imports of manufactured goods declined, though not to the same extent as the exports. The total value of exports was 16,234 million francs, representing a declension of 6392 million francs. Manufactured goods, valued at 10,163 million francs, fell by 3926 million francs. As regards quantities the imports amounted to 30,039,353 tons, or 418,450 tons less than in the first half of 1930, and the exports totalled 15,322,095 tons, a decline of 3,355,259 tons. There was a contraction of about 10 per cent. in the quantity of manufactured goods imported and of 18 per cent. in the exports.

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DEATH.

On July 17th, RICHARD BICKERTON, director of the National Gas Engine Company, Ltd., in his seventy-eighth year.

THE ENGINEER.

VOL. CLII. No. 3941

JULY 24, 1931.

The Classics and the Engineer.

THE visit to Cambridge, which was concluded last Friday, may rightly and fittingly be described as one of the most successful summer meetings organised by the Institution of Mechanical Engineers. Before the event there were, we know, some members who questioned the desirability of holding the meeting at a centre more renowned for its academic institutions than for its industrial establishments. No one who took part in the meeting will be found to sustain that note of criticism. The University and Town of Cambridge are so closely connected in everything that it would have been quite impossible to eliminate the influence of the one from a visit to the other. It was because the University cast its mantle over us that the meeting was so successful and refreshing. Last week, in recording the first day's proceedings, we mentioned the fact that the Vice-Chancellor, in his address of welcome, spoke in Latin, the official language of the University. Incidentally, we suggested that the choice of tongue was, perhaps, more befitting the place than the occasion. Subsequent events showed us that we were wrong. Mr. Ramsay's sonorous sentences may have been but partially understood by the majority of those who heard them. Nevertheless, they and the language in which they were uttered befitted both the occasion and the place. The address foreshadowed what was to be a dominating feature of the meeting, the association of classical culture with modern engineering knowledge. Opinions may differ concerning the value of a classical education to an engineering student, but the Cambridge visit will always remain in our memory as an occasion on which we drew refreshment from the atmosphere which surrounded it.

For, probably, eight hundred years, certainly since 1281, when Peterhouse was founded by Hugh de Balsham, Cambridge has been a seat of learning. Only since 1875 has the University been actively interested in the instruction of students in engineering science. Other universities—Glasgow, for example—were but a little earlier in recognising in a specific manner the importance of our profession. It can, therefore, be said with all truth that the foundations of modern engineering were laid, and that the great advances of the first half of last century were made, at a time when none of our universities included a course of engineering instruction in its curriculum. Some people will, naturally, interpret that fact as indicative of a lack of contact on the part of the universities with practical life and as a reflection on their ability to assist progress. That is a harsh judgment. It would be kindlier, and, we think, more in accordance with truth to dwell upon the significance of the fact that the men who laid those foundations and who made those great advances were men whose education followed, of necessity, severely classical lines. Are we, as engineers, not apt to be a little intolerant of the classics and the attitude of mind which their study is supposed to engender? We think of the classics as comprising a limited number of books by ancient Greek and Latin writers, and as bounded within the covers of a couple of dictionaries, and we contrast the restricted field of classical studies with the boundless, ever-increasing domain of science. There seems to be no room for doubt concerning the relative merits of the classics and of science as means towards the enlargement of mind in their students. On the one hand, the scholar is cloistered within walls which were completed when Rome fell to the barbarians. On the other, he breathes an atmosphere pulsating ever more vigorously with life and new discovery. Surely, we may say, there can be no hesitation in deciding between the claims of the two branches of study as a training for practical life. Yet, if we approach this question in a proper scientific spirit, we are compelled to admit that the evidence is not wholly against the classics and wholly in favour of science. We have the testimony of the Vice-Chancellor of Cambridge University to the effect that some of the best engineering students are found to come from the classical schools. Mr. Ramsay may, perhaps, be set down as a prejudiced witness. Such a charge cannot, however, be laid against the Master of Trinity. Sir Joseph Thomson, before he took to physics and mathematics, trained and qualified as an engineer under Osborne Reynolds at Owen's College, Manchester. Yet at the Institution dinner on Wednesday of last week, he supported vigorously the Vice-Chancellor's advocacy of the classics as a training ground for the engineering and other practical professions. In forceful words, the memory of which will long remain with those who heard them, he assured us that the power of learning for oneself was rapidly disappearing. Many undergraduates, whose scholastic training had been on the "modern" side, did not know how to read. A classical training, he maintained, was distinguished by the ability which it conferred on students to wrest information from books for themselves.

A knowledge of science is essential to the progress of engineering, but a knowledge of the science of ten or twenty years ago is not sufficient. The engineer must learn after he has left his nominal days of instruction behind him. He will, in fact, soon cease to be an engineer if he ceases to learn. The capacity for self-instruction differs in different individuals, but it can most definitely be cultivated. Are we prepared to assert that that capacity can be developed in a school-boy or undergraduate more certainly and more extensively by a training in science than by a training in the classics? It would be, perhaps wise if those of us whose education has been predominantly, or exclusively, scientific, would recognise that our prejudices are against the formation of a sound and fair judgment. At the least, we should admit the possibility that there may be much to be said in favour of an early classical training for engineers. There are some engineers who maintain that it is the only correct training for the profession. We need not go so far as that. It is not, however, difficult to see in what manner an early concentration upon scientific subjects may cramp the self-educative ability of many students and scholars. It is easy to understand that valueless as Latin and Greek may be by themselves in the practical world of to-day, their study may preserve a fluidity of mind at a time in a young man's career when internal forces and external circumstances are co-operating to fix it in some narrow specialised direction. Early specialisation in any department of knowledge is harmful. The temptations towards it in the illimitable field of science are great. No such temptations exist in the classics. In that fact

we have, perhaps, the key to the value of a classical education. It is not, we think, necessarily true that such an education definitely promotes the development of self-learning ability. The truth would appear to lie nearer to the contention that a scientific training, unless most carefully planned and directed, can readily turn into a narrow lane, from which, when it is once entered, great courage and much perseverance are required to withdraw.

Frequency Standardisation.

WHEN consulting engineers were designing generating stations in accordance with their own whims and fancies, and when 25-cycle plant was introduced largely because rotary converters would not work satisfactorily at higher frequency, few imagined that the day would come when all plant operating above or below 50 cycles would be scrapped or modified. If the old system of generation with stations working independently had been continued, there would obviously have been no need to undertake this gigantic task. Standardisation will certainly help manufacturers to reduce the price of machines, whilst the change from 25 to 50 cycles will eliminate the objectionable flicker of electric lamps; but for these reasons alone the task of bringing about a uniform frequency would never have been undertaken. Not a few engineers believe, in fact, that there is no justification for standardisation on the grounds of interconnection, because in Great Britain the need for widespread interconnection is probably less than in any other country. Others maintain that in a few years time D.C. transmission will be possible, when there will be no need for interconnected stations to work at the same frequency. But while high-tension D.C. may show considerable advantages so far as the interconnecting lines are concerned, it is difficult to believe that it will ever be possible to convert A.C. into D.C., and then back again to A.C. without introducing losses and complications exceeding those incurred by the simple process—necessary in any case—of voltage transformation at the ends of the lines.

When general interconnection was deemed to be desirable, the problem of frequency standardisation naturally presented itself, and costly and difficult as the job must prove, it is undoubtedly a better scheme than that of attempting to couple stations through expensive and wasteful frequency changers. But it remains to be seen whether widespread interconnection will prove a great boon to the country. Many regard the proposal to electrify the main line railways as a device to make the "grid" pay and thereby justify its existence. On frequency standardisation alone a very large amount of money is being spent. The net cost was estimated by the Weir Committee at £8,000,000. The same figure was referred to during the passage of the 1926 Bill through Parliament; but in his presidential address, delivered before the Institution of Electrical Engineers in 1925, Mr. R. A. Chaddock fixed the sum at approximately £27,000,000, a figure which now appears to be nearer the mark than that arrived at by the Weir Committee. The true cost of the job will only be revealed when it has been completed, but figures which appear in the last annual report of the Central Electricity Board are instructive. For Central Scotland the estimated expenditure is now £3,781,200; for Central England, £4,336,700; North-West England and North Wales, £452,000; North-East England, £9,065,100; South-West England and South Wales, £804,450, and for South-East England, where the work involved mainly consists of dealing with the Deptford generating station and the undertaking of the London Electric Supply Corporation, Ltd., £100,000. Adding these figures together, we get a total of £18,539,450, which, in view of the difficulty of arriving at a reliable estimate for work of this nature, may still be on the low side. The work is a very long way from complete. Appreciable progress is said to have been made with the changing of motors in the Central Scotland area; less has been done in the Birmingham area, whilst in the Newcastle districts the work has barely begun. All through the change-over process the Board's accountancy staff conducts a continuous audit, so that no question may subsequently arise as to the purpose to which the undertakings have applied the money paid or advanced by the Board. Ultimately, the cost of standardisation will be borne by means of a levy on the supply industry as a whole, which, if recent suggestions are carried out, will meet the capital charges for "grid" and other transmission lines in a similar way. "The installation of new or altered electrical plant on consumers' premises," states the third report of the Board, "will contribute to the work of modernisation and re-equipment of many of the most important industrial establishments in the country." On the other hand, it will result in the scrapping of much good plant, which will be obtainable at scrap iron prices, and manufacturers who have not already electrified their works and who have access to cheap fuel or waste heat might do worse than utilise this plant.

With their usual readiness to grapple with new and knotty problems, British electrical manufacturers have not been slow in meeting the requirements arising from the change-over process, which affects every piece of rotating machinery from the power-house plant down to small domestic motors. One of the most important matters to be kept in mind is, of course, that as far as possible the work must not retard electrical development. Prospective users of electricity are not likely to be in a hurry to install electric motors on a large scale if they find they are liable to be put to the trouble and inconvenience of having them replaced by other motors in, say, a year or two years' time, and, as a result, dual frequency machines, capable of being adapted to the new conditions on site with very little trouble have been introduced. According to the June issue of *The English Electrical Journal*, in 25-cycle areas, a considerable number of these motors have been installed, but it has to be admitted that their performance is a compromise between that of 25 and 50 machines, to an extent depending on the speed and output. In the 40-cycle areas, the utility of the dual frequency "reconnect" motor is less because there are very few speeds common to the old and new frequency. Every factory that has to be dealt with under the scheme must, of course, be considered individually. Whilst dual frequency motors, &c., may often prove desirable in connection with new installations in areas supplied with current at a non-standard frequency, the alternative plan of using a temporary frequency changer until the supply has been altered must not be overlooked. Nor should supply engineers lose sight of the fact that whilst the work of standardisation is going on, much can be done in the way of improving the power factor by persuading some consumers to use motors other than those that draw their magnetising current from the line.

Mining Arsenical Ore in Sweden.

THE following account of a new and unusually interesting mining industry in the northern part of Sweden is by Oscar Falkman, the President of the Federation of Swedish Industries, and is taken from *Skandinaviska Kreditaktiebolaget*. The original article is accompanied by some maps and plans, but it is so lucidly written that we have not reproduced them.

Bolidens Gruvaktiebolag (the Boliden Mining Company) owns a number of sulphide ore deposits in the County of Västerbotten. The most important of these deposits and the only one that has hitherto been worked is that at Boliden, situated to the north-west of the town of Skelleftea at 64° 52′ N. lat., about 30 kiloms. as the crow flies from the coast of the Baltic. A smelting plant, for the treatment of the ore from Boliden and from the other deposits which are eventually to be worked, has been erected on the island of Rönnskär off the harbour of Skelleftea. Between Boliden and Rönnskär there is now a standard gauge railway line of 55 kiloms., part of which, with a length of about 25 kiloms., has been built by the company itself. The remainder is a section of the State railway line from Bastuträsk to Skelleftea.

Boliden and the other ore deposits are all recent discoveries. They were found in the course of very extensive, scientifically conducted prospecting, which began in 1918 and is still proceeding. The exploration of this region, where the existence of ore deposits had hitherto been unsuspected, was occasioned by the discovery of blocks of ore which had been carried along with the inland ice. As the ground there is almost everywhere covered by a deep layer of glacial formation, the ore deposits had been well protected against discovery by the methods of prospecting hitherto known. An entirely new process was now adopted, in conjunction with geological exploration and diamond drilling. This was the method of electric prospecting, which was gradually perfected in Västerbotten, in order subsequently to be adopted in many other parts of the world. This method now usually renders it possible—at any rate, where the geological conditions are similar to those at Boliden—to locate exactly any existing bodies of ore, or other segregations in the rock, which have a different electric conductivity than the remainder of the rock.

The Boliden deposit was discovered at the beginning of 1925. A number of legends have arisen in connection with this discovery. The simple truth is that it was the result of systematic geological and electric prospecting of the area, followed by drilling where electrical indications had been observed in the surveys. There is nothing romantic about it.

One of the reasons why this discovery caused so much sensation was that outsiders had never imagined the possibility of the existence of ore deposits in these parts. Other reasons were the unusual composition of the ore and the great extent of the deposits. The ore is a mixture of arsenical pyrites and iron pyrites, containing copper and gold. The gold occurs as metal in an extremely finely divided state, and can be detected only with a very powerful microscope. The content of gold is on an average about 18 grammes per ton of the ore body. The content of copper, which occurs in the form of copper pyrites, is, on an average, about 2 per cent., whilst the content of arsenic is about 10 per cent. As a certain amount of poorer ore is sorted out in the mining, the percentages of metal in the ore sent to the smelting plant are actually somewhat higher than those above stated. Some 10,000 tons of ore containing up to 80 grammes per ton of gold has, in fact, been sorted out by hand picking and been exported.

When the practicability of the exploitation of the Boliden ore was first investigated, it was found that, owing to the peculiar chemical and physical properties of the ore, the usual processes of reduction could not be employed without modification. After trying various wet and dry processes, a smelting method, involving special arrangements in view of the high content of arsenic, was eventually adopted. The above-mentioned position of the smelting plan on the island of Rönnskär was decided upon after careful consideration of the relative merits of the various sites proposed.

At the smelting plant the ore, after crushing, first goes to mechanical roasters, where the arsenic is removed, together with the major part of the sulphur. The calcine is smelted in reverbatory furnaces, fired with pulverised coal. The product thus obtained is a matte, which is converted into blister copper. The latter contains the precious metals of the ore. The blister copper is sent to the electrolytic refining plant, where refined electrolytic copper is obtained in the usual manner, as well as pure gold and silver.

The gases escaping from the mechanical roasters are conducted through large cooling chambers, where the temperature of the gas is reduced to the level at which the arsenic condenses. In these chambers part of the arsenic is settled out. The remainder is recovered in electrical precipitators. The gases are thus entirely freed from arsenic before they pass to the chimney. The precipitation of the arsenic was one of the great problems, as such high contents and such large amounts of arsenic had nowhere been dealt with before. There was, for example, no experience as to how the cooling chambers should be constructed in order to get the arsenic precipitated in the form of dust, which was essential for the successful operation of the process. It was conceivable that the arsenic might be precipitated in a vitreous form, which would have brought the whole operation to a standstill. It was, moreover, impossible to foresee whether the process might not be impeded by the formation of sulphuric acid from the sulphur contained in the gases. Information on these points could be obtained only by testing the method in practice. After the process had been started it turned out, fortunately, that the arrangements adopted were right.

Another difficult problem was the storage and transport of the arsenic. Obviously, thousands of tons of arsenic per year must be handled with certain precautions. Even a few grammes of arsenic is a quantity to which a certain consideration is usually paid. After a number of experiments, this matter was satisfactorily arranged by a half-automatic method. The arsenic is now transported to a large chamber, made of concrete, where it can be stored without inconvenience for any length of time. It is hoped, however, that it will eventually be possible to dispose of the entire output of arsenic for useful purposes.

The world consumption of arsenic in recent years has been about 40,000 tons per annum. It has been consumed principally for the manufacture of certain salts of arsenic, which are used for the destruction of pests in cotton plantations, &c. Rather considerable quantities have, moreover, been used for the impregnation of timber. This latter use, in particular, might be considerably extended. Arsenic is a cheap and effective preservative, and can safely be used for this purpose. Possibly, however, people will not venture to use it for the preservation of timber for dwelling-houses.

An entirely new and promising field for the utilisation of arsenic is for the preservation of concrete constructions. As is generally known, concrete constructions in running water, such as dams, power stations, &c., have, in many cases, become defective after being in use for some twenty or thirty years. This is due to the dissolution by the water of the free lime in the concrete and the consequent disintegration of the latter. It has now been discovered that, if the cement is admixed with a certain proportion of arsenic, the latter binds the free lime formed during the hardening of the concrete, and that this compound is practically insoluble. As neither the lime nor the arsenic can, then, be dissolved, the concrete will be water-resistant. The principal factors which have a bearing on the utilisation of this property of arsenic are now being subjected to intensive scientific investigations. These researches also comprise the consideration of other methods than the direct admixture of arsenic.

The erection of the smelting plant at Rönnskär was started in the spring of 1928. It was at first designed for a comparatively small output, but, in 1930, in view of the successful working of the smelting process, the company decided to extend the plant to many times its originally intended size. These enlargements are expected to be substantially completed in the course of the first six months of 1932.

The mining plant at Boliden is now practically completed. But, in order to facilitate the mining of the upper part of the ore-body, it will be necessary to strip about 1 million tons of glacial overburden from the surface of the deposit. Excavators driven by electricity are being used for the purpose. This work is expected to take several years. The company, moreover, contemplates the erection of a concentrating plant for removal of the major part of the iron pyrites, which now unnecessarily encumbers the smelting process.

A New Prime Mover.*

By J. F. J. MALONE.

HEAT ENGINES: THEIR GENERAL CHARACTER.

ALTHOUGH an external combustion furnace is necessary to produce gas from coal, we define all engines that burn fuel in their cylinders as internal combustion engines. The heavy oil engine has the highest efficiency of all known heat engines; it has a low power-weight ratio and cannot use cheap fuel, coal. Although a modern marine steam engine can produce cheaper power than the heavy oil engine, it is being displaced by the latter owing to the great reduction of the weight and space occupied by its fuel.

The internal combustion coal dust engine is not a practical commercial engine, owing to the mechanical damage from the products of combustion. The gas engine has a high efficiency and needs a minimum of attention and upkeep, but its fuel is costly; for relatively small powers, where gas is cheap, electricity dear, and skilled attendance scarce, it is a good engine. The petrol engine has the highest power-weight ratio and needs a minimum of attention and upkeep; its efficiency is moderate, but its fuel is costly; it is the only practical engine for aircraft and for most motor cars. The light oil engine stands between the heavy oil engine and the petrol engine, and for relatively small powers, where gas and electricity are dear or unobtainable, it is the best type of engine.

External combustion engines burn their fuel in separate furnaces; notwithstanding, it has been proposed to burn fuel inside steam boilers, and in the Still engine the heat for the steam part of it comes from fuel burned in the internal combustion part of it. The steam engine and boiler has simplicity and dependability, a low efficiency, and in small units high attendance costs; except in isolated cases the small oil engine has displaced it. For locomotive duty the steam engine is supreme; its low efficiency is balanced by the low price of its fuel; it has no gears.

The mechanical damage when using a high superheat has set a practical limit to the efficiency of a modern marine steam engine; although it can produce power cheaper than a heavy oil engine, yet the comparatively great weight of fuel required to be carried tends to restrict its use.

Below 100 H.P. an internal combustion oil engine is better than a steam engine; above 2000 H.P. the turbine is better, and where weight of fuel is a factor the heavy oil engine is better.

The steam turbine and boiler is free from reciprocating weights and vibration, has a high power-weight ratio, can use a high degree of superheat, and has, in large units, a high efficiency. In large units, when burning coal, it produces the cheapest power of all heat engines. Its great speed is an advantage for the generation of electricity; the disadvantages for marine purposes are the gearing, the number of auxiliaries necessary, and its duplication for a reversing duty. It is supreme in large power stations, in warships, in large liners, or where large units of power are required.

The hot air engine and furnace had a low efficiency; its furnace efficiency was very low, and its engine efficiency was higher than the steam engine; apparently no attempt was made to isolate the furnace and the engine and examine each separately. Its power-weight ratio and its mechanical efficiency were low; the part of the engine in contact with the furnace was overheated and burnt. Its only uses have been in small-powered engines where fool-proof requirements were the first consideration.

METHODS OF PRODUCTION OF POWER FROM HEAT; VARIOUS CYCLES AND HEAT REGENERATORS USED IN HEAT ENGINES WITH A GASEOUS MEDIUM.

In a steam engine we put heat into the water in the boiler and turn it into steam; this heat does work by increasing volume at constant high pressure and temperature; this is isothermal expansion. This work comes out on the piston while the steam enters the cylinder; at cut-off no more heat enters the cylinder, hence, as the piston still continues to generate work, it has to draw upon the heat in the steam and its temperature falls; this is adiabatic expansion.

After the exhaust port opens the steam leaves the cylinder, enters the condenser, and turns back to water; work is put into the steam by the piston to cause this decrease in volume at constant pressure and temperature, isothermal compression. The condensed water is pumped back to the boiler *viâ* a feed-water heater. In this type of engine the heat regenerators are feed water economisers and furnace air preheaters; they take their heat from the furnace waste gases.

In a steam turbine the expansion is adiabatic; its regenerators are similar to those of the steam engine.

In the hot air engines a perfect cycle would have two isothermal stages, or changes of volume at constant temperature, and two constant volume stages for heating and cooling, with a heat regenerator taking the heat when the medium is cooling and giving up the heat when the medium is heating.

In internal combustion engines the cycles vary, the sudden combustion or heating at approximately constant volume—the petrol engine—the slower combustion or heating at approximatley constant pressure—the Diesel engine.

The contents of the internal combustion engine cylinder can be divided into two groups, the chemically inert and the chemically active; the inert contents are much the larger part; they are compressed, then heated, and then expand; the active contents that contain all the initial energy are compressed, then burned, during which changes of volume occur, due to chemical changes, and during these chemical changes most of the heat of combustion is transferred to the inert part of the cylinder contents. Hence we could say that the internal combustion engine is primarily an inert gas expansion engine, somewhat comparable to a hot air engine without a regnerator. To exclude the inert contents from the cylinder is to turn the cylinder into a gun; the combustion would in an engine sense be uncontrollable.

THE PERFECT GAS CYCLE.—THE EFFICIENCIES OF VARIOUS CYCLES USED.

All heat engines have used a gaseous medium for turning heat into work, and the relationship between pressure volume and temperature of a gaseous medium while generating or absorbing work has been very fully investigated.

$\frac{T_1-T_2}{T_1}$ = the maximum efficiency of any heat engine, when T_1 and T_2 are respectively the absolute temperatures at which heat enters and leaves the gas during the working cycle.

Heavy oil engine efficiencies are 47 per cent. indicated and 33 per cent. brake. Petrol engine efficiencies are ,26 per cent. indicated, 22 per cent. brake.

The gas engine will have slightly lower values than the heavy oil engine, and the light oil engine values will be halfway between the heavy oil engine and the petrol engine.

The huge power station turbine will have $T_1 = 750$ deg. and $T_2 = 80$ deg. Fah., the efficiencies being 55 per cent. $\frac{T_1-T_2}{T_1}$ efficiency, 22 per cent. brake efficiency.

The T_1 and T_2 of various classes of engines with their $\frac{T_1-T_2}{T_1}$, indicated, and brake efficiencies, are approximately as follows:—The saturated steam locomotive will have 400 deg. and 230 deg. Fah.; the efficiencies are 20 per cent., 5·5 per cent., 5 per cent. The superheated steam locomotive will have 550 deg. and 230 deg. Fah.; the efficiencies are 31 per cent., 8 per cent., 7 per cent. The saturated steam marine engine will have 400 deg. and 125 deg. Fah.; the efficiencies are 32 per cent., 10·3 per cent., 8·7 per cent. The superheated steam marine engine will have 550 deg. and 125 deg. Fah.; the efficiencies are 42 per cent., 14·7 per cent., 12·5 per cent. The hot air engine probably had 1200 deg. and 350 deg. Fah., the efficiencies being 57 per cent., 9·6 per cent. and 6·7 per cent.; this engine had a very low furnace efficiency. Preheaters were unknown in its day, hence the engine performance, as apart from furnace losses, was very good.

REGENERATORS.

This name is given by engineers to a device that takes heat that has hitherto been thrown away and puts it back into the heat and work circuit. The funnel base heat regenerator is called an air preheater; it takes heat from the waste gases and puts it into the air entering the furnace. Thin-walled tubes, flat and corrugated plates are used with gas and air on alternate sides of plate or tube; another type mechanically move masses of metal with maximum surface that carry heat from gas to air, heating and cooling as the masses of circular plates slowly revolve. The heat regenerators used in mechanisms producing extremely low temperatures are of small tubular construction. The heat regenerators in the hot air engine consisted of flat plates; the gas flowed backwards and forwards in the same aperture; in all the above regenerators there is constant flow in one direction.

A NEW ENGINE: THE LIQUID ENGINE.

Hitherto all heat engines have used a gaseous medium; in this engine the thermodynamic medium is a liquid. It is in some features similar to the hot air engine, viz., the medium does not undergo any chemical or physical change; it has a heat regenerator; the whole of the medium at any instant is approximately the same pressure; it has no exhaust. It is different in some features from the hot air engine, viz., the medium is a liquid; the quantity of medium in the regenerator is much greater than the quantity of medium not in the regenerator; the engine does several revolutions to make the medium move once around its circuit; the medium in the regenerator always flows in one direction; the regenerator is moved mechanically by the engine; most of the work produced by the engine is from the medium in the regenerator and not from the medium in contact with the sources of heating and cooling. Its general features are the small quantity of medium required, less than 1 lb. per horse-power, and its freedom from wastage; its long thermal range, its ability in even small powers to give a good efficiency and to use cheap fuels, such as coal, its freedom from explosive hazards, and its silence and elasticity.

WHY A LIQUID MEDIUM?

It has been experimentally found that, when liquids are made to move correctly in properly dimensioned films with metal walls, an exceedingly high heat transference efficiency is obtained. Heat transferers can heat and cool liquids as quickly as the periodicity of alternating electricity with less percentage of loss than that which occurs in a large modern static transformer. Without this phenomenon the liquid engine could not economically exist.

Another prime factor for the use of liquids is that their dilatation is greater than their compressibility, thus allowing great changes of pressure with small relative changes of temperature.

There is also their freedom from explosive risk, their capacity for generating power from a very small volume of liquid, and their flexibility of operation and design; another factor is that all joints and glands are cold.

EXPANSION, COMPRESSIBILITY, SPECIFIC HEAT, AND MAXIMUM DENSITY OF LIQUIDS, COMPARISON WITH GASES.

Dilatation of liquids cannot be explained by any simple formula; as, for instance, gases can be explained with $P V = R T$. Any one liquid can have its dilation explained in terms of P, V, and T, but it would not be a simple formula, and with liquids having a maximum density above absolute zero temperature the formula would be very involved.

If we avoid liquids while they have a negative dilatation, and at or near their point of maximum density, then dilatation of liquids can be said to increase with a rise in temperature or pressure; near to their critical temperature and pressure their dilatation is greater than gases.

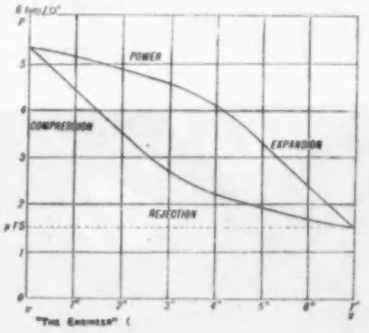


FIG. 2

Compressibility of gases nearly follows the simple formula at constant temperature of $P_1 V_1 = P_2 V_2$, but each liquid has a difference of compressibility; any one liquid could have its compressibility explained in terms of P, V, and T, but it would be an involved formula. If we avoid liquids near their point of maximum density then compressibility can be said to become easier as temperature rises or pressure becomes less; liquids near their critical temperatures and pressures are very easily compressed.

The second law of thermodynamics is the prime law of all heat engines, and given the correct curves of dilatation and compressibility a specific heat curve could be made.

Maximum density in a liquid except at zero absolute temperature prevents that liquid from operating thermodynamically; it cannot change heat into work or *vice versâ*; the compressibility and specific heat values only change a little, but dilatation nearly ceases.

THE CYCLE SELECTED.

Fig. 1 shows a purely diagrammatic sectional model of an elementary form of engine, capable of being operated to aid a description of the engine cycle or one revolution of the crank shaft, as well as to aid a description of the thermodynamic circuit in the regenerator, or, as I call it, the thermodynamic or T.D. pile. The excentric operating the T.D. pile in the T.D. tube should be rigidly connected to, should lead the crank by about 90 deg., and move with the crank operated from the ram in the engine cylinder; they are separated on the model for simplification of explanation. The pressure gauges show the pressure of the liquid when the ram end is opposite a gauge, either coming out or going into the cylinder.

We will now investigate the engine cycle or one revolution of the crank shaft. The ram, Fig 3, is now right in the cylinder and the T.D. pile at its midstroke, with the pressure at 5·3 tons per square inch. While we move the

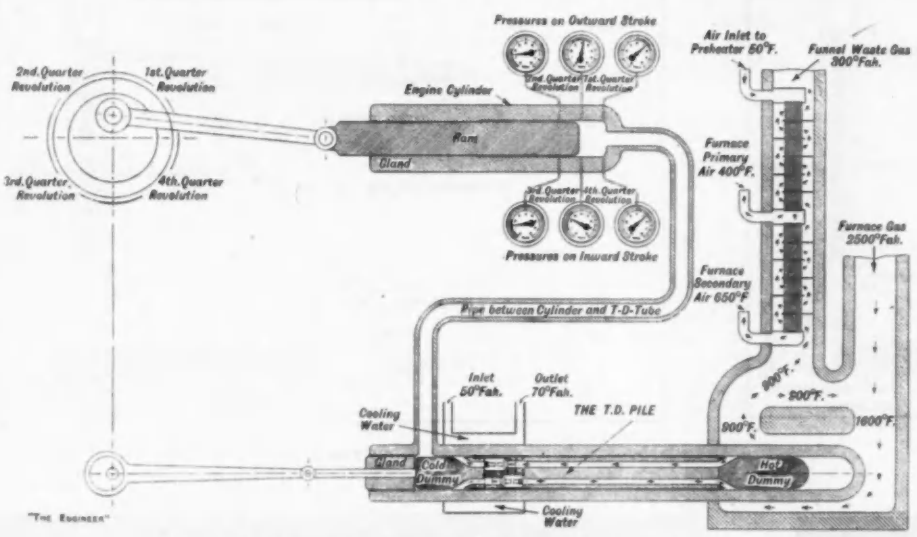


FIG. 1—DIAGRAMMATIC SECTION OF MALONE HEAT ENGINE

* Royal Society of Arts, June 4th, 1931.

THE MALONE PRIME MOVER

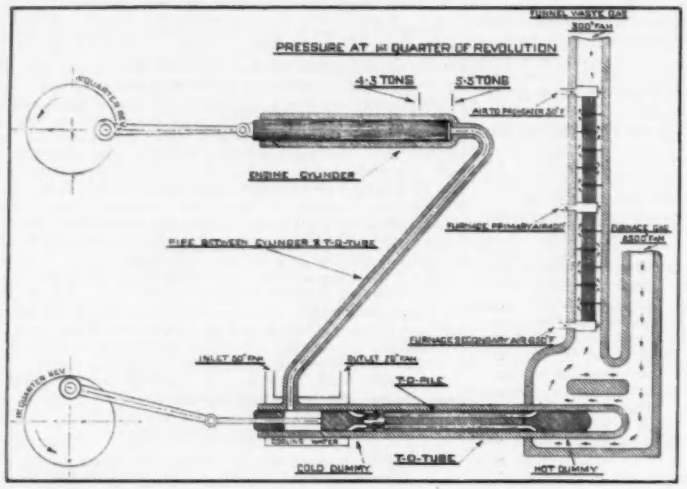


FIG. 3

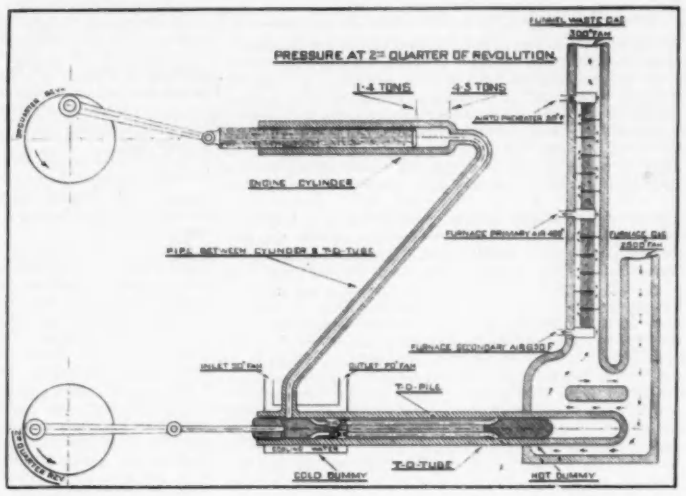


FIG. 4

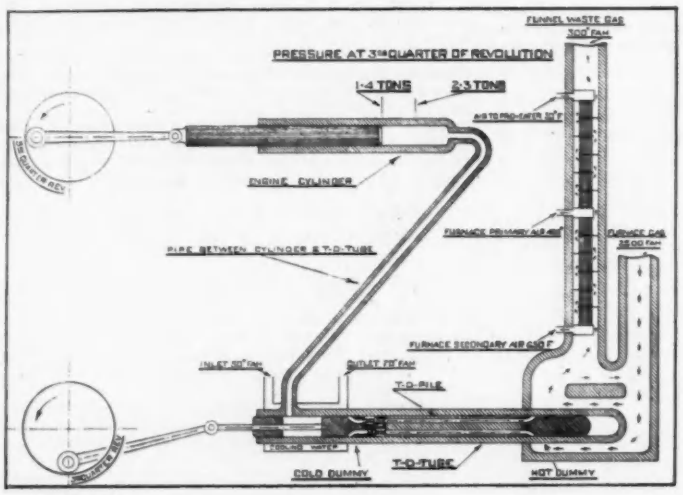


FIG. 5

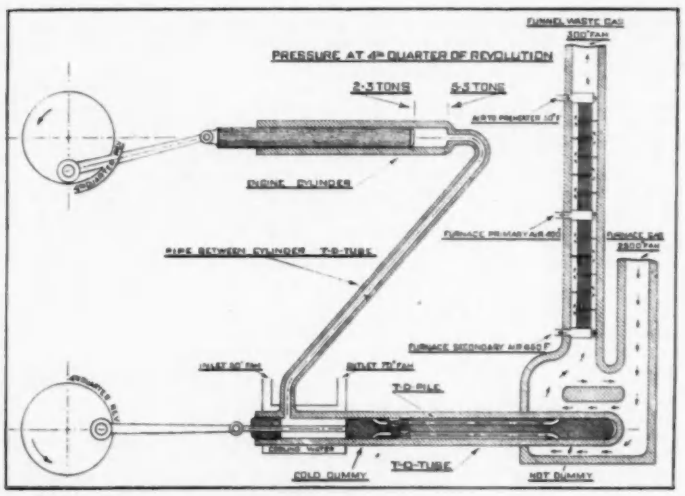


FIG. 6

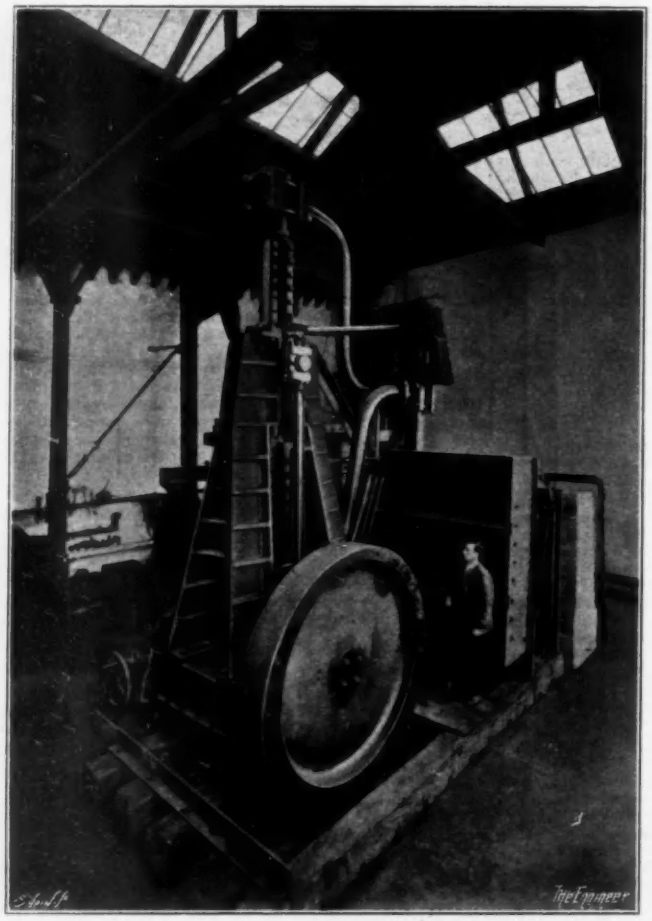


FIG. 7—FIRST VERTICAL ENGINE

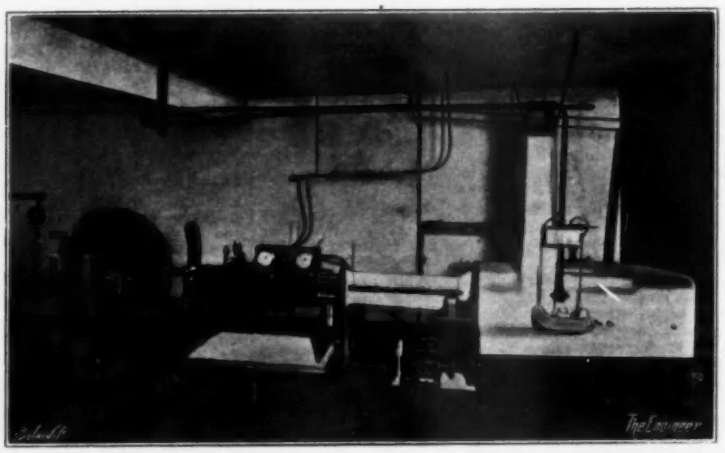


FIG. 8—SMALL HORIZONTAL ENGINE

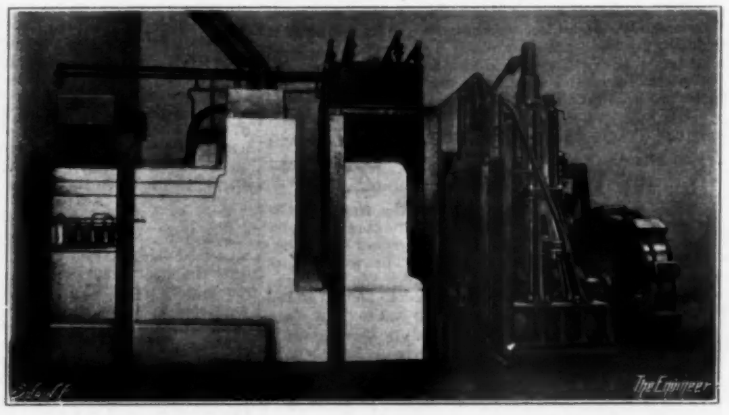


FIG. 9—SECOND VERTICAL ENGINE

engine shaft the first quarter of a revolution the ram moves half a stroke out of the cylinder, and the pressure falls to 4·3 tons per square inch; simultaneously the T.D. pile moves to the cold end of the T.D. tube—see Fig. 4. We now move the engine shaft the second quarter of a revolution, during which the ram moves to the outward end of its stroke, the pressure falling to 1·4 tons per square inch; simultaneously the T.D. pile moves from the cold end of the T.D. tube to its half-stroke position—see Fig. 5. While we move the engine shaft the third quarter of a revolution the ram moves half a stroke into the cylinder, and the pressure rises to 2·3 tons per square inch; simultaneously the T.D. pile moves from its half-stroke position to the hot end of the T.D. tube—see Fig. 6. We now move the engine stroke the fourth quarter of a revolution, during which the ram moves to the inward end of its stroke, the pressure rising to 5·3 tons per square inch; simultaneously the T.D. pile moves from the hot end of the T.D. tube to its mid position—see Fig. 3.

We will now investigate the thermo-dynamic circuit in the T.D. tube, but first we will describe the various parts of this power generating element, the T.D. tube and its contents.

Here, Fig. 10, we have a strong steel tube, kept hot at the closed end by hot gases of combustion, and kept cold at the gland end by circulating water or air; at the ends of the T.D. pile there is the cold dummy and the hot dummy; their purpose is to provide cooling and heating surface on the inner walls of the T.D. tube, for the liquid that comes into contact with them. The T.D. pile, which is really thin films of liquid between metal tubes or plates, is shown here as two relatively large passages with plain non-return

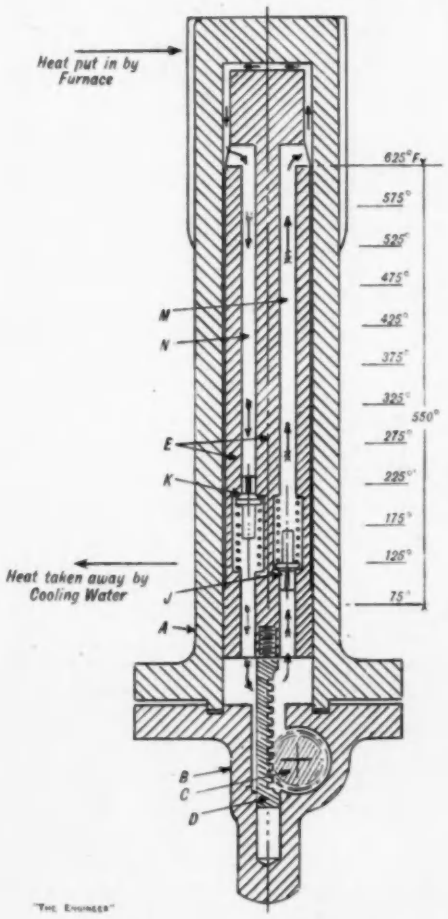


FIG. 10—SECTION OF REGENERATOR

valves at its cold end. The T.D. pile, dummies, and valve box are rigidly held together and move as a whole by the small T.D. pile rod operated by the excentric sheave. This unit, as a whole, forms a displacer, and so forces the liquid through the T.D. pile from the cold end to the hot end, and *vice versâ*, light piston springs at the valve box end of the cold dummy preventing liquid from passing outside the T.D. pile. It will move from the hot end to the cold end during the fourth and first quarter revolution of the engine shaft, while the pressure rises from 2·3 to 5·3 and falls from 5·3 to 4·3 tons per square inch—say, an average of 4·3 tons per square inch.

During the second and third quarter revolution of the engine shaft the unit formed by T.D. pile, dummies, and valve box will move from the cold end to the hot end of the T.D. tube, while the pressure falls from 4·3 to 1·4 and rises from 1·4 to 2·3 tons per square inch—say, an average of 2·35 tons per square inch.

It will be noticed that while we move the T.D. pile from the hot end to the cold end of the T.D. tube the liquid only moves in one passage to the T.D. pile; during this operation the moving liquid in the T.D. pile takes heat from the metal and stationary water in the T.D. pile, and the water that surrounds the hot dummy takes heat from the heating surface of the T.D. tube; it takes heat at an average pressure of 4·3 tons per square inch.

When we move the T.D. pile from the cold end to the hot end of the T.D. tube the liquid only moves in the other passage of the T.D. pile; during this operation the moving liquid in the T.D. pile gives heat to the metal and stationary water in the T.D. pile, and the water that surrounds the cold dummy gives heat to the cooling surface of the T.D. tube; it rejects heat at an average pressure of 2·35 tons per square inch.

It will be noticed that the 90 deg. lead of the excentric ahead of the crank causes the greatest movement and displacement of liquid in the T.D. pile, while the ram moves and displaces least; also that, while the ram moves and displaces most liquid, the T.D. pile moves and displaces a small amount of liquid. Hence we put heat into the liquid medium while pressure is rising, due to ram compression of liquid in the fourth quarter revolution of the engine shaft.

While the ram reverses movement we put heat into the liquid medium, and cause a rise of pressure. During the first quarter revolution of the engine shaft we put heat into the liquid medium, during a small fall of pressure and a large increase of volume. During the abstraction of heat from the liquid medium we reverse the above. Hence we have no truly adiabatic, isothermal, constant volume or constant pressure heating or cooling. At full power the T.D. pile stroke would be at a maximum, and seven revolutions of the engine shaft would force all the liquid in the T.D. tube once around the T.D. tube circuit.

The power of the engine is controlled by the alteration of the stroke of the T.D. pile. The reversibility of the engine is controlled by two sheaves and a link motion, similar to a steam engine. Fig. 2 shows an indicator card, such as would be taken off an engine operated in the manner shown in explaining the engine cycle; it would be then at about 0·8 full power and have a mean effective pressure of 1 ton per square inch; at full power the mean effective pressure would rise to about 3000 lb. per square inch.

THE MOST SUITABLE LIQUID, AUTHOR'S EXPERIMENTS.

The first small engine had a mercury medium; the first large engine—see Fig. 7—had a few days' run with oil as a medium; all the engines since have used water as the medium.

Many liquids have been tested in the test plants and most of their physical properties valued, oils, petrols, spirits, mercury, liquid CO_2 and SO_2, and other liquids, and after carefully valuing their strengths and weaknesses water has been selected as the best thermo-dynamic medium for this new type of engine. The liquid medium needs to be a mobile liquid between atmospheric temperature and a temperature at which steel has an economic strength. Next, it should have a stable and level specific heat. Its compressibility should be proportionate to its dilatation, it should be a stable compound not easily dissociated chemically, and it should not be explosive, poisonous, nor too readily burnt. Mercury is a good liquid. Its advantages may at some future date overcome its high cost. Metallic alloys in a liquid state fail because they have too high a fusion temperature and their molecules are unstable. Oils are either too viscous at a low temperature or their molecules are too unstable at a high temperature. Sodium and potassium and alloys of them are too dangerous. Water needs a high bottom pressure, it has a large and, at a high temperature, a climbing specific heat if the bottom pressure is not kept up, but for practical purposes water is at present the best medium known. Of course, many other liquids could be used, and, if necessary, two or more non-mixable liquids could be used with mechanical methods of keeping them separated, or two separate liquids in two separate systems, employed in series thermally.

THE REGENERATOR.

The diagrammatic lay-out of an elementary form of engine shows the regenerator or, as I call it, the T.D. pile, in a diagrammatic form, or as shown in Fig. 10. This clearly shows the circuit of the liquid, and that the liquid in any aperture only moves one way.

In Fig. 11 we have a drawing of an actual T.D. pile built up of concentric tubes with the water films in between each tube.

[The author showed a T.D. pile and tube which had run over 20,000,000 revolutions, without anything, including the valves, having been touched.]

The face of the T.D. pile at its cold end is so arranged that every alternate film of liquid moves in a similar direction at the same instant; the two non-return valves decide which of the two groups of liquid film shall move or stand still. The T.D. pile has a uniform temperature gradient along its length.

For any specified efficiency of an engine using the same design of liquid film the speed of the film will be approximately constant; hence the required revolutions per minute of the engine at full power determines the length of the T.D. pile. The thickness of the liquid film of the T.D. pile on the table is 0·01in. The engine that used this pile had an indicated efficiency between heat and work of about 30 per cent.

PRACTICAL METHOD OF HEATING THE LIQUID, THE HEATING UNIT.

Any type of fuel can be burned in an external combustion furnace and the hot gases of combustion conveyed to the heating unit. The furnace is supplied with preheated air, the primary supply being taken halfway down the preheater at the highest safe temperature, the secondary supply being taken from the hot end of the preheater. The preheater is heated by the waste gases

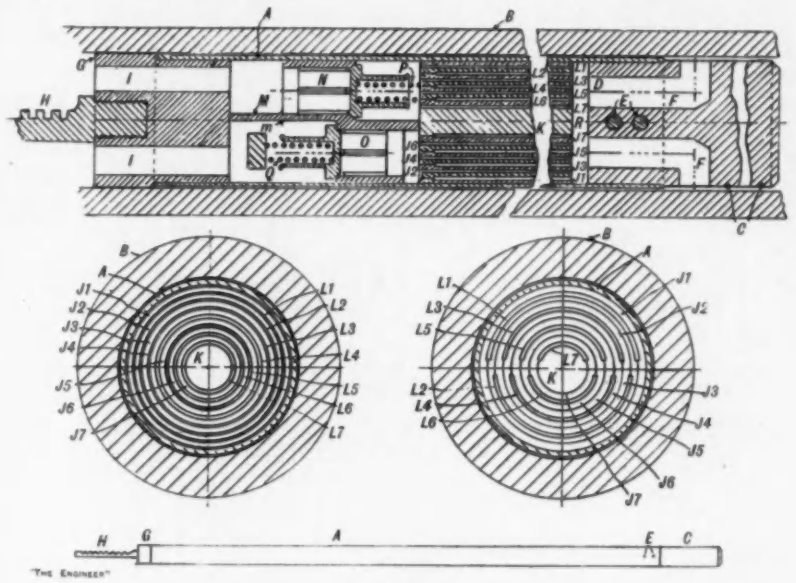


FIG. 11—A T.D. PILE

that leave the heating unit and pass, *viâ* the preheater, to the funnel and so to the atmosphere.

The heating unit has a mechanically operated gas circuit, which takes a weight of hot gas at maximum temperature into itself from the furnace, and rejects from itself the same weight of gas at the coldest part of the gas circuit.

The gas circuit at its coldest part ejects some of the gases into the preheater; the remainder moves further around the gas circuit at its lowest temperature, and takes into itself some of the furnace gases at their hottest temperature; the resultant mixture at a medium temperature circulates around the hot ends of the T.D. tubes, and in heating the tubes and therefore the liquid inside them cools the heating gases; these cooled gases move around

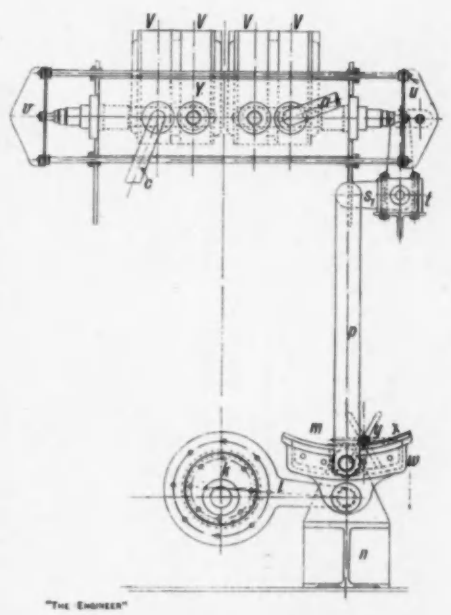


FIG. 12—CONTROL GEAR

the circuit either to the preheater or to mix again with the hot furnace gases. Hence the gas circuit is heated to a moderate temperature by an influx of very hot gases and cooled by the T.D. tubes.

This method of only allowing a moderate temperature of gas to make contact with the T.D. tubes effectively prevents them from being overheated. It means that convected heat rather than radiant heat is what is desired; this requires a relatively large heating surface and a relatively small amount of heat absorbed per square foot of heating surface.

Although this increases the weight of the engine, it makes the heating unit fool-proof; the engine can be operated by an unskilled man without any risk of damage by overheating.

The engine could run at full power with a fierce furnace

and be suddenly stopped for an indefinite time without touching the furnace and without any risk of damage from overheating.

The Method of Utilising the Expansion.

The expansion of the liquid either in the T.D. pile or at the heating surface at the hot end of the T.D. tube is passed right through the liquid to the end of the ram in the engine cylinder; as no liquid can leave the T.D. tube without passing the cooling surface it means that the engine cylinder and the liquid in it are always cold.

The Theoretical Efficiency of the Liquid Engine.

If we had no heat lags and no mechanical losses and a liquid without any physical change, the theoretical efficiency would be $\frac{T_1-T_2}{T_1}$, the temperatures being taken where the liquid enters and leaves the T.D. pile.

A perfect steam cycle and a perfect water cycle would have about the same thermo-dynamic efficiencies. The advantage of water engines over steam engines is that a small water engine is very much more efficient than a small steam engine, and most power units required do not exceed a few thousand horse-power; to obtain water engine efficiencies the steam cycle can only be used in steam turbines of large power. Knowing that a perfect gas has thermo-dynamic advantages over saturated vapours or liquids, it may be asked why not use a perfect gas; the answer would be that gas in a liquid engine cycle would give hopeless results. The perfect heat engine will have to use a perfect gas, but no known engine cycle can do it; this is an ideal I have constantly before me.

Experimental Liquid Engines.

Various heat regenerators or heat transferers have been made and the results of the experiments have governed the design of this new engine. Various liquids have had their dilatation and compressibility measured at pressures up to a thousand atmospheres, and at temperatures up to 750 deg. Fah.

Fig. 7 shows the first vertical engine; it had eighty large tubes and two engine cylinders. It ran for a few days with an oil medium; for the rest of the time the liquid used was water. Extensive experiments were carried out on this engine between 1925 and 1927; the art of operation, power control, reversibility, methods of heating, were learned on this engine. The furnaces used were plain refractory ones and the fuels used were coal and coke. The T.D. piles, eighty in number, were operated by a cam and not by a sheave; this meant that for every alternate quarter of a revolution the T.D. piles remained stationary for a quarter of a revolution. This gave a theoretical advantage, but not sufficient to justify a cam movement, with its inherent complications and weaknesses, against a sheave movement with its comparative simplicity and strengths. The speeds varied between 24 r.p.m. and 180 r.p.m., dependent upon the purpose of any particular experimental run.

We now turn to the illustration Fig. 8 of the small horizontal engine, which was built in 1927, and has run well over 30,000,000 revolutions and is constantly in demand for demonstrations and tests.

Many days have been spent on brake tests and an analysis of the various losses has been tabulated. Various designs of T.D. tubes were experimentally tried out, as well as the kind of steel to use in their manufacture. Various designs of T.D. piles were tested. The correct type of joint to adopt for this new engine was decided upon. The finer points of design of the method of heating and its correct operation were also determined.

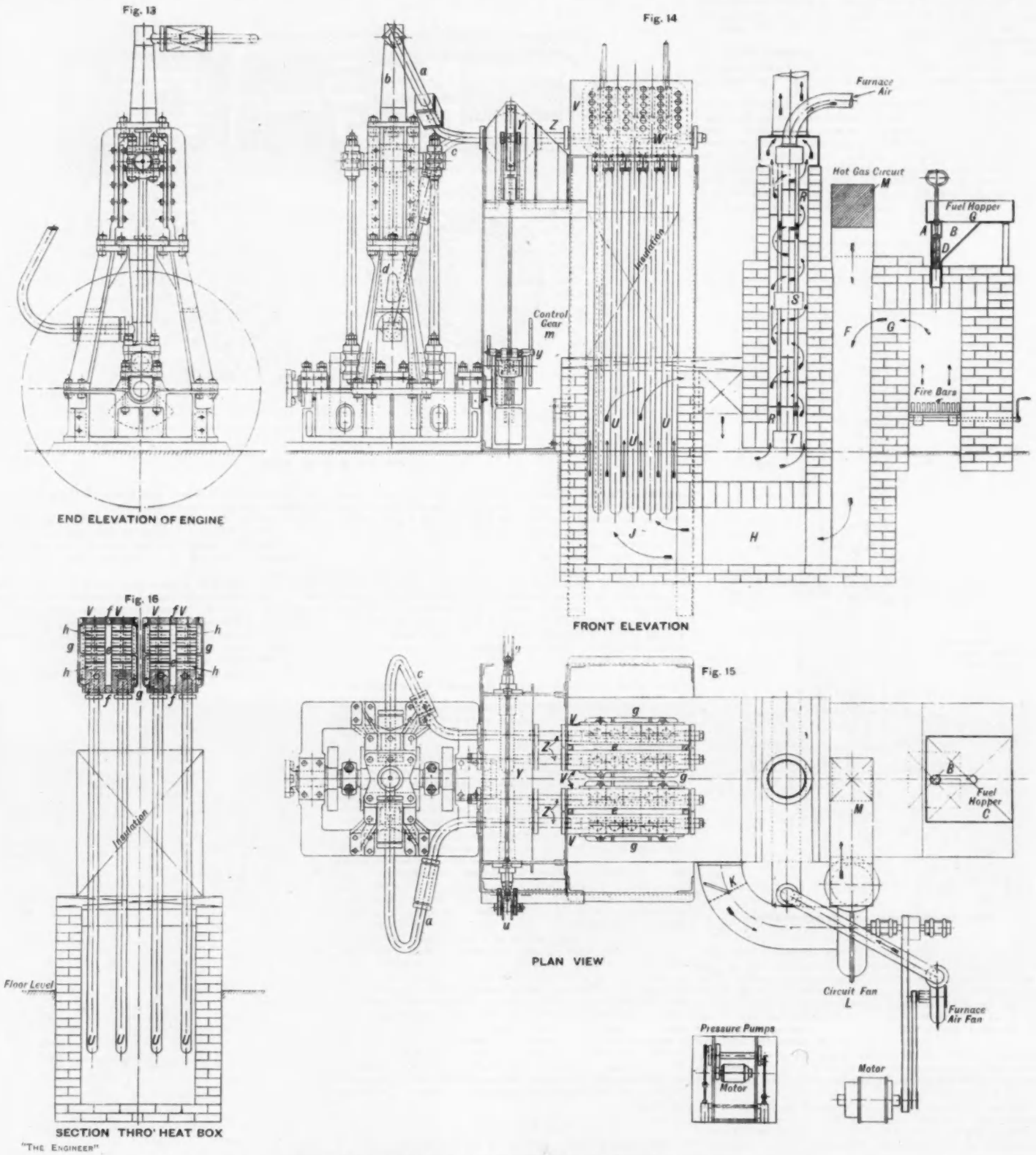
The speeds varied between 40 r.p.m. and 250 r.p.m.; the T.D. stroke varied between ¼in. stroke, running light, to 3¼in. stroke, running on full load. With everything cold and from ten minutes of lighting up the furnace this engine was running smoothly.

Fig. 9 shows an illustration of the second vertical engine; it has twenty small tubes and two engine cylinders. Figs. 12 to 16 show sectional views of this engine.

The results of its experimental runs have completed the practical development on this type of engine up to the stage when commercial development is now ready to begin.

The Results of Tests.

The average of three brake trials by three different independent engineers gave 27 per cent. indicated efficiency. Thus, after allowing for furnace and mechanical losses in a good commercial engine from 100 B.H.P. upwards, 20 per cent. overall efficiency between the heat in the coal and the shaft horse-power can be expected in



FIGS. 13 TO 16—SECTIONAL VIEWS OF SECOND VERTICAL ENGINE

an engine weighing 330 lb. per indicated horse-power. A heavier engine would give a higher efficiency, and a lighter engine would give a lower efficiency. This means 12,725 B.Th.U. per B.H.P. and 10,816 B.Th.U. per I.H.P., or 0·61 lb. good oil or 0·87 lb. good coal per B.H.P. and 0·51 lb. good oil or 0·74 lb. good coal per I.H.P.

COMPARISON WITH GASEOUS ENGINES: WEIGHT AND COST, AND ADVANTAGES CLAIMED.

A liquid engine locomotive could give the same power for half the coal consumption and no water consumption, have a greater starting effort, being free of gears would be as elastic, would occupy the same space, and would weigh and cost the same as a good type steam locomotive; it would need no periodic cleaning and be entirely free from explosive risk. For work where there is no water and only vegetation fuel this engine is ideal. For marine purposes this engine can generate power 33 per cent. cheaper than the most efficient superheated steam engine, and with its weight, space and cost no greater, the bunkers would be 33 per cent. smaller. The fuel for a marine heavy oil engine would cost three times as much as the cost of coal for this engine, the cost and weight of this new engine would be less than the cost and weight of the marine heavy oil engine; the lubricating oil and repairs in this engine would cost less than in the heavy oil engine.

The "Whitewash" Coach.

THE Whitewash coach of the Great Western Railway has now become a regular piece of apparatus for the inspection of the road. It is described in the July issue of the Company's *Magazine*, whose Editor has courteously given us permission to reproduce the article and lent us some of the illustrations. The article runs as follows:—

The need for ensuring that railway travel shall afford a comfortable journey for its patrons has become increasingly important during the past few years. On the Great Western Railway the value of comfort has long been recognised, and the quest for satisfaction in this respect has involved the carrying out of a long series of tests with coaching stock, as well as an intensive examination of the permanent way.

Coaching stock tests revealed the nature of the factors which affect the riding, and as a result stock has been designed and built having very pronounced improvement in the riding characteristics. To obtain the full effect of this improvement it is necessary that the road upon which the stock is running shall be maintained in the best possible condition. Tests are therefore carried out from time to time over the main lines of the system to detect any causes of bad riding due to track faults which may not be discernible on the ground, even to the practised eye.

The track is tested by means of a specially equipped coach, used as a track indicator. The "riding" of this coach under standard conditions has been proved by previous tests to be very consistent, and can therefore be taken as a definite criterion of the state of the track.

The behaviour of the coach is recorded by means of a Hallade recorder, of which a description appeared in a recent issue of the *Magazine*. When the "riding" of the coach is disturbed more than a predetermined amount a specially designed electrical apparatus opens a valve, and whitewash is deposited on the track, thus marking the position at which the disturbance took place. This marking of the track draws the attention of the permanent way ganger to the particular spots at which his examination is required to be specially exhaustive.

The apparatus which drops the whitewash is operated by the side-sway of the coach, which causes a secondary coil to slide within a primary coil, the field strength of the latter being kept constant by the operation of the train lighting system, from which the current for operating the whole apparatus is obtained. The movement of the secondary coil in the field of the primary induces a current in the secondary, the strength of the resulting current depending only upon the speed of side movement of the coach. When this speed of movement is excessive the secondary current is sufficiently strong to cause a sensitive relay to close. This relay is of the mercury dipper type, and is shown on the right in Fig. 1. The secondary current energises the twin coils of the relay and pulls down the horizontal arm so that its free end dips into the small pot of mercury beneath it. This mercury dipper contact completes a circuit through a second relay, which is seen on the left in Fig. 1. This second relay is known as the slow-releasing relay, and serves to prolong the effect of the closing of the mercury dipper beyond the actual duration of the contact in the mercury. The slow-releasing relay, in its turn, operates an electro-mechanical relay, which is designed to maintain the closure of an electric contact for a minimum period of one second. This latter contact energises electro-magnets which operate the valve controlling the whitewash.

The whitewash is contained in a small pot with a flap valve at the bottom. The flap is kept closed by a spring-loaded "toggle" joint, and is opened by the electro-magnets overcoming the spring. These electro-magnets are energised by the operation of the electro-mechanical relay, as explained above. The whole of the contents of the pot—about one quart—is dropped each time the flap valve is opened, and the pot is replenished automatically from a storage tank immediately the flap shuts.

FIG. 3—OUTLET PIPE

The whitewash dropping mechanism is illustrated in Fig. 2. The whitewash pot, electro-magnets, "toggle" joint links, and spring are clearly to be seen in the illustration. The flap is encased in the shute which surrounds the base of the pot, and guides the whitewash into the outlet pipe on to the track. This outlet pipe is seen in Fig. 3. The open end is cut away, as shown, to prevent air baffle of the whitewash at high speeds.

In order to prevent settling of the whitewash, and consequent choking of the pipes, it is circulated in the tank by means of a pump, which also serves to replenish the tank from reserve drums as required.

As may be expected, owing to the speed of the train, the whitewash appears on the track about 60ft. from the place which caused disturbance of the coach.

When whitewash is dropped, a motor horn sounds in the coach, and at the same time a mark is made on the Hallade record by means of an electric pen which has been fitted to the recorder for this purpose.

The whole apparatus can be adjusted to any desired degree of sensitivity, and the consistency of the results obtained is very satisfactory. The test coach with its special equipment has been used over most of the main routes of the system, and has detected many hidden causes of unsatisfactory "riding."

The use of the apparatus is one of the many efforts which are constantly being made to maintain the proud claim that for comfort and safety in travel, as well as for other attributes of efficient transport, it is best to "Go Great Western."

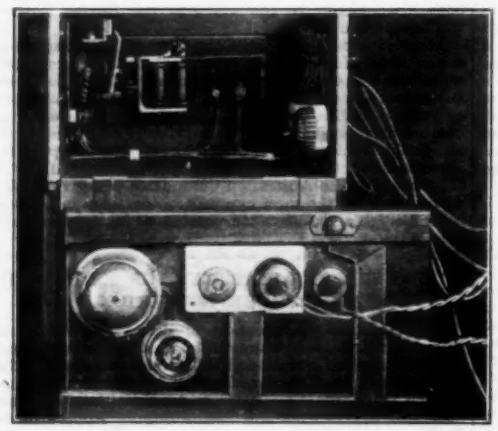


FIG. 1—ACTUATING APPARATUS

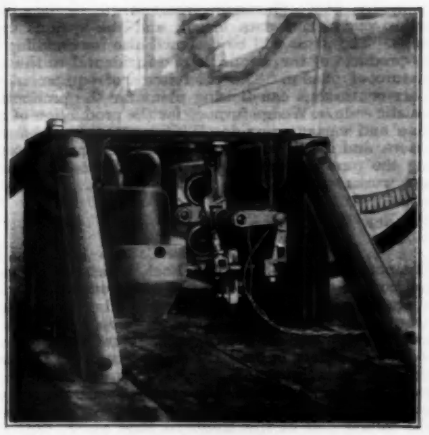


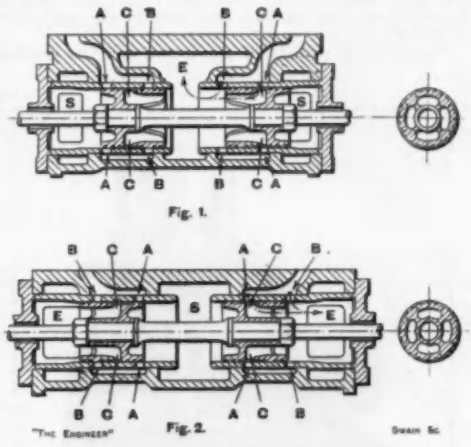
FIG. 2—WHITEWASH DROPPER

OWING to the success attending last year's competition, the Institution of Welding Engineers has decided to offer the Gold Medal of the Institution and a prize of £10 10s. for the best paper by a working welder, whether a member of the Institution or not, but resident in the British Empire, on "Welding and Cutting on Railways and Tramways" for this year's competition. Particulars can be obtained from the Secretary of the Institution at 30, Red Lion-square, London, W.C. 1.

Double Exhaust Piston Valve.

IT has often been said that whilst it is easy enough to get steam into a locomotive cylinder, it is difficult to get it out again, and many devices have been invented with that purpose in view. One of the best plans is to increase the stroke of the valve, which is now becoming almost the standard practice, but, as an alternative, the London, Midland and Scottish Railway is fitting a piston valve with a double exhaust passage, as shown in the sketch below—Fig. 1 for external and Fig. 2 for internal admission.

In each case steam is admitted to the cylinder through the ports marked A only. The exhaust from the cylinder is, however, able to pass through both ports A, and also through the additional ports B, the exhaust steam from ports A passing through the passages C in the valve. In this way a larger area to exhaust is provided, or, regarded in another way, this is equivalent to a piston valve moving with twice its normal velocity when opening to exhaust or closing to compression, thus avoiding any wire drawing. Owing to the freedom of exhaust during the exhaust period, there is less back pressure in the cylinder at the instant when compression commences, so that the final compression pressure is considerably reduced. This has the effect of enabling an engine to be worked with a very early cut-off without incurring excessive compression, which in many cases with a normal type of valve prevents an engine from working with a cut-off as early as would otherwise be desirable. It will be appreciated that with this arrangement it is essential that the piston valve rings shall be steam-tight, as otherwise there would be a greater risk of leakage than with a normal valve, but with suitably designed piston valve rings and stops, this part of the problem has been satisfactorily solved.



LOCOMOTIVE PISTON VALVE

The characteristic results obtained with engines fitted with this valve are that they are extremely free running, can be worked with an early cut-off, thereby ensuring economical working, and also they have the peculiar feature that the valves are less liable to become carbonised than with the ordinary type.

The above type of valve is used on engines with a short valve travel, as it is not considered necessary to use this type on long travel engines, which are already able to work with an early cut-off without undue compression. The long travel valve gear with plain valve and the short travel gear with the double exhaust valve may therefore be regarded as alternative methods of obtaining the same result.

SIXTY YEARS AGO.

IN 1871 the Institution of Mechanical Engineers—its headquarters were still in Birmingham—held its summer meeting at Middlesbrough under the chairmanship of the President, Mr. John Ramsbottom. It was no holiday affair, but purely a business meeting, relieved only by one social engagement, the annual dinner. From our issue of July 28th, 1871, we gather that on the morning of the first day of the meeting no less than six papers were presented. In those days it was the custom for the secretary to read all the papers to the meeting, whether the authors were present or absent. On that Tuesday morning, sixty years ago, the secretary must have had a hard task. First, he had to read a paper "On the Manufacture of Hematite Iron," by Mr. William Crossley; then one by Mr. (Sir) Lowthian Bell, on "The Preliminary Treatment of the Materials used in the Manufacture of Pig Iron in the Cleveland District." Next he had to read a paper by Mr. Alfred Hill, describing the compound-cylinder blowing engines at Lackenby Ironworks. As these engines had not been completed at the time of the meeting, the paper, in accordance with the rules of the Institution, was not discussed. Then came a paper by Mr. John Jones, on the general geological features of the Cleveland district, which was followed by one by Mr. J. A. Haswell describing the brake-drums on the Ingleby incline. Finally, the secretary had to read a paper by Mr. Jeremiah Head, dealing with an improved form of steam engine governor, which was claimed to give a close approximation to perfect action. . . . We may also notice the meeting of another society reported in the same issue. Under the chairmanship of Mr. Glaisher, the Aeronautical Society had held a conference at which several papers had been presented. Mr. Glaisher reported that, as a consequence of the use made of balloons during the siege of Paris, many people, not hitherto interested in aerial locomotion, had been led to inquire into its merits. Mr. Proctor sent a communication in which he expressed his interest in the forthcoming experiments by Messrs. Browning and Wenham on the laws of pressure

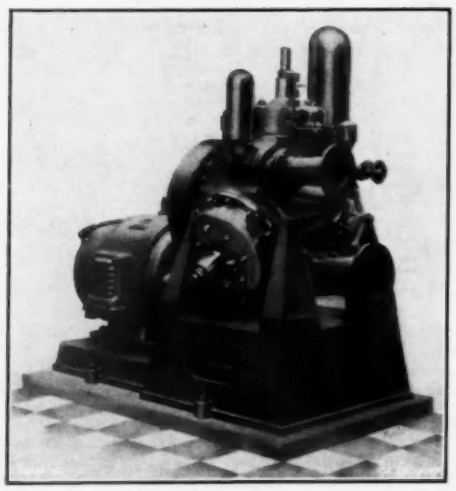
and velocity. He added that he thought that the principle of the gyroscope would enter largely into the construction of future aerial machines. Among the papers presented was one by Mr. Alexander, entitled "On Aerial Flight as Dependent on Man's Muscular Exertion." In the course of the discussion, Captain Burnaby stated that the muscular power of a bird was proportionately 200 times as great as that of a man, and that for successful ballooning it would be necessary to have some power 500 times greater than that of a man, yet not heavier. If we take the power of a man at one-fifth of a horse-power and his weight at 11 stone, Captain Burnaby's forecast gives 1·54 lb. per horse-power, a figure which is in remarkable agreement with the average weight of modern aero engines.

A Stationary Fire Pump.

WE illustrate herewith a new piece of fire-fighting apparatus, just supplied by Merryweather and Sons, Ltd., of Greenwich, for the protection of the Royal Dutch Naval Base at Sourabaya, Java.

It consists of an electrically-driven "Hatfield" pump, the general features of which are familiar to our readers. It is a treble-barrel, single-acting plunger pump, the barrels being arranged radially and symmetrically round a crank shaft in the same plane, with the plungers operated by connecting-rods from a single crank. A large suction valve area is obtained together with a minimum air space between the suction and delivery valves, so that a good efficiency is secured on deep lifts. The valves and plungers are, nevertheless, readily accessible. The crank chamber is totally enclosed and the gear runs in an emulsion of oil and water.

The pump is entirely of gun-metal, and has polished



copper air vessels on the suction and delivery branches. The valves are of india-rubber and of disc type. It is driven through a silent chain speed-reducing gear by a three-phase motor, designed for a current of 220 volts. The motor is supplied with an automatic starting control, by means of which the pump starts to operate immediately the pressure in the delivery main falls below a predetermined point.

The pump is capable of delivering 600 gallons per minute against a total head of 264ft. when lifting water from a depth of 10ft., and of delivering 550 gallons per minute against the same head when lifting from a depth of 16ft. 6in.

Canadian Engineering News.

St. Lawrence Waterway.

IT is notable that the Speech from the Throne, delivered at the recent opening of the Canadian Parliament, did not contain any reference to the St. Lawrence waterway project. This is taken generally to mean that the Dominion Government is not prepared to proceed in the immediate future with the improvement of navigation and the development of power on the St. Lawrence. It is observed that, while every other major question or problem was dealt with, the Speech made no mention whatever of the seaway scheme, and it is assumed that the Government will not move in the matter until the position of the National Exchequer is considerably improved. Some of the Cabinet Ministers are strongly in favour of development of the seaway without further delay, but Premier Bennett is disposed to move with caution, though he is committed to the project by election pledges.

Beauharnois Gets Additional Rights.

The Quebec Government has granted permission to the Beauharnois Light, Heat, and Power Company to divert an additional flow of water from the St. Lawrence River to enable the company to develop a greater amount of electricity at the big development taking place 25 miles above Montreal. The company is given rights for the diversion of 30,000 cubic feet of water per second from Lake St. Francis by means of the canal now under construction, in consequence of representations that the Beauharnois Company had negotiations under way with important clients who propose to establish industries which will require an additional 135,000 horse-power of electric energy. The plans for the additional works to permit the increased diversion and utilisation of water in the power-house which is being built on the shore of Lake St. Louis, will have to be approved by the Federal Government so as to protect navigation. Under contracts signed to date, the Beauharnois Company can be called upon to deliver 462,000 horse-power of the 500,000 horse-power which will be available from the development now under way. Delivery of the first blocks of power will commence on October 1st, 1932.

Benzine Extraction Plant.

The extraction of benzine from the waste gas of the Turner Valley on a commercial scale is being furthered by the Alberta Government. Premier Brownlee announced recently that the Government would build a semi-commercial plant at Calgary this year for test purposes. Government action was determined upon after a series of highly successful experiments in the development of the new process, which were conducted by Dr. E. H. Boomer, of the University of Alberta. These experiments will now be continued in the test plant to be built in Calgary.

Concentrator for Quebec Mine.

The Aldermac Mine in the Rouyn district, North-Western Quebec, is to be brought into production, possibly late in the autumn, as a result of the decision of the directors of Aldermac Mines, Ltd., to proceed almost immediately with the erection of a 500-ton flotation concentrator. An interesting feature of the decision to put the mine on a producing basis is the expectation that large quantities of pyrites will be marketed for the production of sulphur. The utilisation of the sulphur is the result of the process developed by Horace Freeman, for which the inventor was given the Randolph Bruce Medal at the recent annual meeting of the Canadian Institute of Mining and Metallurgy. It is a process for the production of sulphur-dioxide gas for manufacturing the sulphite cooking liquor used in paper mills in the production of chemical pulp. The process has been in continuous operation in one of the mills of the Canada Power and Paper Corporation, and besides the important factor of utilisation of a Canadian source of sulphur, large economies are claimed for the paper-making industry over the use of imported sulphur. The process not only produces the sulphur-dioxide gas required, but provides heat for steam production, which is a direct saving, and iron oxide as a by-product for use in the production of iron and steel. The pyrites preferred for the process are flotation pyrites containing 50 per cent. or more of sulphur, and the Aldermac concentrator, it is understood, will be designed to produce such a product. The Aldermac ore, it is stated, will run about 60 to 70 per cent. pyrites and around 2 per cent. copper. On the basis of the proposed operations, the Aldermac is expected to produce about 6,000,000 lb. of copper annually. The copper concentrates are to be shipped to the Noranda smelter, where blister copper will be produced.

Chemical Plant for Toronto.

A modern plant for refining tar acids is being built in Toronto by the Dominion Tar and Chemical Company, Ltd. The main products will be pure phenol, ortho, meta, and para cresol, and the various cresylic acids. The plant will be designed also for handling other by-products of tar, available and incidental to the manufacture of phenol. The chief items of equipment are a Dorr continuous causticising plant for the production of caustic soda, a Wedge furnace for the production of quicklime and carbon dioxide, Whitney double-effect evaporators, and a still with fractionating columns for separating the pure products. The capital expenditure on the new works will be close to 250,000 dollars.

New Wire Plant.

The new works of the Canada Wire and Cable Company, Ltd., at Montreal East, which is equipped to roll copper rods, draw wire and carry out other finishing operations, has started operations. The plant, which is near the new refinery of Canadian Copper Refiners, Ltd., from which it will receive copper bars, marks an important step in Canadian industrial development. At the present time there is in the Dominion only one other copper rolling mill, from which copper manufacturing companies can secure copper rods. With the placing in operation of the rolling mill at the Montreal East plant, copper rods are being produced for use in the wire-drawing machines in another section of the plant, and are available for use in other copper manufacturing plants in Canada, thus lessening the dependence on outside sources for an important material in Canadian manufacturing.

Ore Treatment Project.

The Minister of Trade and Commerce announces that negotiations are under way for an entirely new trade pact with South Africa. Its basis is to be an exchange of lumber from Eastern Canada for manganese ore, and, in connection with the arrangement, negotiations are said to be already under way for the establishment of a large plant in the vicinity of Montreal for the annual treatment of from 100,000 to 200,000 tons of manganese ore. The plans, however, have not as yet reached a definite stage.

New Oil Refinery.

A petroleum refinery to manufacture Stellarene, a new motor fuel, is being erected at Coutts on the Canadian side of the Alberta–Montana boundary, by the North-West Stellarene Company. The plant will have a capacity of approximately 1500 barrels of crude oil per day, and, including equipment, an estimated expenditure of 350,000 dollars is involved. The new plant comprises two complete and separate units, the cracking unit embodying the new vapour phase method and the regular straight run or topping unit to process the crude oil in preparation for its conversion into Stellarene. Besides the special equipment required for the Stellarene process, the plant embraces many new features of modern oil refinery design.

B.E.S.A. Specifications.

All B.E.S.A. Specifications can be obtained from the Publications Department of the Association at 28, Victoria-street, London, S.W. 1. The price of each specification is 2s. 2d. post free, unless otherwise stated.

BOILER CODES AND PUMP TESTS.

The recommendation of the Imperial Conference regarding the co-ordination of all codes and standard specifications issued within the British Empire is already having a beneficial effect. Particularly is this the case in connection with Australian and British standards in the engineering field. A notable example is the Australian Boiler Code recently issued, which is under review by the Standards Association of Australia, and has been forwarded to Great Britain for comment with a view to ultimate co-ordination in so far as may be practicable. In consequence the British Engineering Standards Association, as the result of a fully representative conference of boilermakers and users, classification societies, insurance companies, Government Departments and others interested, has nominated a strong executive committee to prepare a set of British Standard Boiler Rules and Specifications. The conference, which was largely attended, was held at the Institution of Mechanical Engineers, under the chairmanship of Mr. William Reavell, Chairman of the Mechanical Industry Committee, and the Association has appointed Rear-Admiral Sir Robert Dixon, K.C.B., to accept the chairmanship of the committee.

Moreover, the boilermakers of the country have come together and formed a permanent makers' panel, under the chairmanship of Lieut.-Colonel E. Kitson Clark, President of the Institution of Mechanical Engineers, and have nominated some twelve of their number on to the above Executive Committee to represent the whole of the boilermakers' interests of the country. This collaboration places the Executive Committee on a fully representative basis. Should occasion arise, the representatives of the boilermakers on the Executive Committee will be at liberty, through this makers' panel, to consult all the manufacturing interests in order to bring to the Executive Committee the consensus of opinion of the producing interests on any point at issue.

The Committee is also assured of the fullest support of the engineering insurance companies. It is probable that, at their own request, these companies will be entrusted with the preliminary work of co-ordinating certain portions of the proposed rules which, from their long experience and very intimate knowledge, they are in a peculiarly good position to undertake. It is interesting to note that the boilermakers have already broadly considered the question as to the best method of dividing up the work, which will, as far as possible, follow the lines of the existing divisions in industry. Such a grouping, bringing together automatically as it does makers and users who are most familiar with the problem in hand, leads to the work being dealt with more efficiently and expeditiously than in any other way.

The Australian Committee has already signified its desire for cordial co-operation in the work, and it is hoped that rules, governing the design and construction, &c., of boilers, applicable to the whole of the British Empire, will be agreed upon.

The Mechanical Industry Committee of the Association, as the result of a unanimous recommendation from a fully representative conference of pump users and makers, has authorised the constitution of a Pump Test Committee to co-operate with a similar Committee in Australia, which has recently issued a draft Australian Pump Test Code. Mr. Richard Allen, C.B.E., of Bedford, has accepted the chairmanship of this Committee. It is understood that in this case also the Australian Committee will give British representations the most careful consideration in order to bring British and Australian practice as far as practicable into harmony.

MAINS SUPPLY APPARATUS FOR RADIO AND ACOUSTIC REPRODUCTION.

An important specification of direct interest to all manufacturers and users of "battery eliminators," trickle chargers, mains-operated wireless sets and radio-gramophones, has just been issued by the British Engineering Standards Association under the title of "British Standard Specification for Mains Supply Apparatus for Radio and Acoustic Reproduction." This specification applies to all devices—with certain specified exceptions—intended for supplying current and/or voltage not exceeding 500 volts to apparatus employing thermionic valves for radio and acoustic reproduction and similar purposes, wherein the energy is derived from A.C. public or private supply mains. It applies equally to such devices whether they are incorporated in a common container or cabinet with the radio or amplifying apparatus, or whether they are constructed and used separately from it. In the former case the complete apparatus comes within the scope of the specification. Amplifiers used in connection with "talkie" installations and public address systems in which the anode voltage usually exceeds 500 volts do not come within the scope of the specification, but it is important to note that all "mains supply apparatus," even the smallest "battery eliminator," used for broadcast receivers and "all-mains" portable receivers, are to be regarded as electrical power apparatus and as coming within the provisions of all rules and regulations relating thereto issued by competent authorities.

The specification is divided into five main parts and three appendices, these dealing respectively with the scope of the specification, definitions, electrical characteristics, marking, design and construction, specification of flexible cords and cables, measurement of output "hum," and definition of "quality." This latter definition is of particular interest, as the specification indicates a method of assessing the performance of the apparatus as regards freedom from residual ripple voltage—or "hum." The specification also deals with the question of voltage regulation, a common fault with many "battery eliminators" in the past having been the rapid falling off in output voltage as the anode current increased.

It should be noted that this specification, while covering a certain amount of ground at present dealt with by the I.E.E. Wiring Regulations, is in no way in conflict therewith, the Committees responsible for the preparation of the specification and the regulations respectively having worked in close collaboration.

The Institution of Civil Engineers.

APRIL EXAMINATIONS, 1931.—PASS LIST.

PRELIMINARY (131).

M. O. K. Anstiss, C. W. Armstrong, J. B. Baird, S. A. Barlow, A. S. Bateman, E. A. Bell, F. H. W. Bevis, J. L. Bleazard, G. H. Brader, G. A. Button, E. C. Byers, V. Carnegie, H. A. Clayton, H. Clearie, T. C. Clucas, H. C. O. Coombe, G. Cowan, N. S. Crisp, R. H. Crofts, M. K. Culley, D. S. Cuthill, T. H. S. Davidson, D. L. Davies, J. R. Davies, J. R. M. Dawson, O. G. Duncan, M. W. J. Eaton, C. W. Edwards, H. M. Epton, J. H. Garside, L. C. Gilbert, D. R. Gilchrist, J. C. Gill, P. M. Gough, H. Gove, J. P. Graham, M. Graham, G. G. Grieve, R. E. Gutteridge, J. R. Hall, C. E. Handley, J. H. Harley, K. L. Harrison, R. L. Higgins, J. Hine, G. R. Hope, B. R. Hungerford, J. Hunter, E. S. Jeavons, L. S. Jeffery, C. U. Jessop, J. T. Kendal, R. S. Kevill, E. G. King, J. R. King, A. Kinmont, F. M. Knight, D. Laws, O. S. Lean, J. Lindsay, J. B. F. Lochhead, W. H. W. Maass, D. C. McCormick, R. M. Macfarlane, J. R. McGrouther, J. MacIntyre, J. C. Mackinder, A. H. P. McLaughlin, T. McMillan, N. A. McNeil, B. A. Mahoney, T. D. Manning, C. D. Margach, R. S. Martin, J. R. A. D. Maule-Finch, J. Miles, W. J. Millns, W. G. Mitchell, D. D. Murray, E. S. Neal, J. Nicholls, P. E. Norman, S. W. Norman, C. A. Novis, E. A. Oliver, S. C. Oxley, J. P. M. Pannell, P. B. Petrie, R. W. Plowright, F. J. Potter, R. G. T. Powell, G. W. Pyatt, J. H. Rawlinson, E. D. Rees, K. W. J. Rice, J. S. Roberts, S. D. M. Robertson, N. R. Rose, B. B. Sampson, A. Sim, J. Sim, jun., T. Simpson, G. N. Slyfield, G. M. Smith, S. B. Sparkes, R. H. Spencer, N. Stathacopulos, A. K. del Strother, C. J. Telfer, F. H. Thomas, E. M. Thompson, H. MacL. Thomson, I. M. Thompson, R. R. Tisdale, C. E. H. Topping, A. E. Valler, W. H. Wake, C. N. Ward, J. M. Warrington, J. H. J. Watson, A. Welch, C. Whitehead, J. B. Whitehead, J. Wilkinson, A. Wilson, K. L. Wilson, G. H. R. Wingate, C. C. Wood, H. C. S. Woolcott, S. G. K. Wright, L. Yarborough.

ASSOCIATE MEMBERSHIP (271).

Whole Examination (Sections A, B, and C) (4).—E. W. F. Clements, A. Fisher, F. T. R. Hicks, A. E. N. Taylor.

Sections A and B only (13).—K. S. Bell, T. P. Bulloch, S. N. Casey, F. A. Claudius, C. E. Fonseka, P. E. Golvala, H. G. Haylock, A. G. Kent, N. Parry, N. N. Reddy, J. H. Strang, L. D. G. Taylor, J. P. Walton.

Sections A and C only (1).—C. G. Sexton.

Sections B and C only (16).—A. T. Black, E. F. Boivie, D. L. Brown, T. D. Burdis, J. S. Cope, D. Currie, L. H. Dickerson, S. A. Findlay, R. B. Francis, T. G. Hand, J. W. M. Hawksworth, T. L. Maccabe, S. T. Monté, A. E. Smith, A. Sutherland, G. E. Woodhead.

Section A only (77).—H. B. Baldwin, B. F. Barber, J. B. Bennett, J. P. Bett, A. E. Blyth, W. Bryant, J. Caldwell, H. T. Clausen, R. T. Cooke, A. D. L. Copp, H. B. Creighton, H. Crichton, E. W. Denholm, H. E. Dohoo, D. A. Evans, H. V. Evans, D. Exley, L. C. S. Farmer, G. E. Forward, R. E. Gardner, J. B. Gibson, A. Gray, M. Harbottle, R. E. Harris, J. G. H. Heasman, F. Hodson, E. B. Holiday, T. E. Hooley, A. W. Hubbard, J. I. Hutchinson, H. N. Jenner, E. R. H. Kevill, H. K. King, J. W. Kirkwood, J. R. Langridge, P. Leach, C. Leng, D. D. Lewis, A. S. Lovegrove, S. M. Lovell, A. H. Marshall, A. S. Moody, A. N. Moon, A. M. Moon, T. Muir, G. H. Mutimer, G. Nest, H. C. Orchard, M. J. Page, M. F. Palmer, H. H. Pattullo, J. F. M. Perrott, J. R. Pilkington, E. E. Pool, P. Ransome, D. Reid, J. L. Ringrose, A. W. Rodmell, W. D. Sangwin, D. R. Scott, I. D. Scott, J. W. Scott, G. E. Sewell, E. R. Sly, J. A. F. Smith, W. S. Smith, M. A. Speir, C. H. Stanger, C. G. Thompson, C. D. Trinder, F. Wade, S. A. S. Walton, A. J. Watkins, H. J. Welch, A. C. Wildsmith, T. A. K. Wilson, G. D. Wyatt.

Section B only (49).—W. M. Anderson, H. W. Barkas, J. P. Beveridge, F. D. Blaker, R. F. C. Booth, K. A. Cole, H. F. Daniel, D. T. Davis, C. E. Day, A. B. Duncan, T. G. Elliott, H. H. Evans, C. M. Field, A. Frew, jun., L. M. Gardiner, E. Graham, A. Grant, W. J. A. Gray, S. A. Green, L. J. Grimshaw, N. W. Hampson, W. C. Hayward, G. A. Hill, C. Hodgson, J. V. Jackson, C. F. V. Lawton, M. C. Leney, R. Lloyd, J. F. S. MacDonald, G. A. Mather, G. N. Maynard, F. R. Paynter, G. A. H. Philipiah, C. G. Reddington, C. M. Roberts, S. P. A. Sandberg, J. L. Scott, G. Shaw, J. G. Smith, J. F. G. Spring, V. E. Stanbridge, B. S. Summers, C. K. Tallack, W. F. Tunks, W. A. Turner, W. H. Vickers, E. Walker, O. J. Watt, H. W. Wood.

Section C only (111).—J. V. Alexander, B.Sc. Eng. (Lond.), F. M. Andrews, B.A. (Cantab.), H. V. Apcar, B.Sc. Eng. (Lond.), A. L. Archibald, E. Armstrong, F. C. Ball, B.Sc. (Birmingham), J. Barratt, D. W. G. Barren, B.Sc. Eng. (Lond.), R. C. Bashford, B.Sc. Eng. (Lond.), E. O. Baxter, B.Eng. (Liverpool), D. C. Bean, B.Sc. Eng. (Lond.), W. J. Bineham, T. L. Bowring, T. E. Brand, B.Sc. (Glas.), A. F. Brennand, B.A. (Cantab.), G. S. Brightwell, B.Sc. Eng. (Lond.), R. C. Brown, B.Sc. Eng. (Lond.), H. Bruce, B.Sc. (Edin.), J. I. Carswell, B.Sc. (Edin.), D. H. W. Channon, B.Sc. Eng. (Lond.), H. C. H. Crawley, E. J. Cridlan, N. W. Crisp, A. Curry, R. H. Cuthbertson, B.Sc. (Edin.), H. R. Davenport, T. F. Davey B.Sc. Eng. (Lond.), D. G. Davies, W. A. De Silva, B.Sc. Eng. (Lond.), J. Drake, B.Sc. (Manchester), H. J. Eddie, F. Edmondson, B.Sc. (Manchester), O. Elsden, B.Sc. (Manchester), A. F. Fadelle, B.Sc. Eng. (Lond.), R. H. Falkiner, B.A.I. (Dubl.), R. H. Ferguson, B.Sc. (Edin.), E. J. Flight, B.Sc. Eng. (Lond.), W. Fogg, B.Sc. Eng. (Lond.), A. C. U. Forrest, J. F. Fraser, O. Gibson, B.Sc. (Manchester), S. C. Gray, B.Sc. (Edin.), A. E. Greig, G. D. D. Greig, F. Grisley, B.Sc. Eng. (Lond.), G. A. Hallidie, B.A. (Cantab.), C. Harland, B.Sc. (Wales), J. A. Harper, C. A. Hart, B.Sc. Eng. (Lond.), W. Hawksley, B.Eng. (Liverpool), A. P. Healy, B.E. (National), R. F. Heaney, G. E. Hill, R. Hilton, G. D. Jackson, B.A.I. (Dubl.), J. D. W. Jeffery, J. E. Jones, B.Sc. Eng. (Lond.), J. R. Kennedy, B.Sc. (Durham), W. G. King, J. D. Knowles, G. H. Lee, B.Sc. Eng. (Lond.), A. Linford, B.Sc. Eng. (Lond.), D. K. McKenzie, B.Sc. (Edin.), W. B. McLauchlan, B.Sc. (Glas.), D. H. McPherson, B.Sc. (Edin.), L. S. R. Mangénie, B.Sc. (Edin.), E. J. Manson, B.Eng. (Liverpool), H. Martin, W. W. D. Minson, B.E. (N.Z.), E. A. Moore, B.Sc. (Bristol), W. H. Morgan, B.Sc. Eng. (Lond.), D. Moss, B.Sc. Eng. (Lond.), J. P. Moyle, B.Sc. (Manchester), R. G. Murdoch, A. W. Nettleton, A. W. Poynor, B.Sc. Eng. (Lond.), G. E. Roberts, B.Sc. Eng., (Lond.), E. C. Robinson, B.Sc. (Manchester), A. D. Ross, B.Sc. (Edin.), K. P. Rush, A. T. Scott, B.Sc. (Manchester), C. W. Scott, B.Sc. (Manchester), W. H. Sebley, J. Shepherd, N. P. Simansky, A. F. Simpson, R. C. Smith, W. McC. Smith, H. Sorrell, C. H. S. Spaull, C. H. Spens, J. D. S. Stephen, S. Stevens, B.Sc. Eng. (Lond.), L. J. A. Stow, R. Struthers, B.Sc. (Glas.), D. G. Sutherland, B.Sc. (Edin.), J. A. Thomson, J. W. Tonge, B.Sc. (Manchester), F. C. Tudball, B.Sc. (Bristol), A. G. Tyson, B.Eng. (Liverpool), W. A. Wakefield, B.Sc. Eng. (Lond.), A. Walker, B.A. (Cantab.), J. Walker, B.Sc. (Manchester), C. E. Watson, W. H. Weston, B.Sc. (Glas.), A. C. White, B.Sc. Eng. (Lond.), M. C. White, B.Sc. (Edin.), T. MacG. Whyte, B.Sc. (Edin.), C. V. Williams, N. S. Williams, G. A. Wilson, B.Eng. (Liverpool).

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Languid Conditions.

THE trade pulse in the Midlands and Staffordshire remains feeble. Listlessness characterises most of the producing works, activity in all departments being of a very limited character. All the staple industries of the district are depressed and the small orders which are secured after much competition are insufficient to find more than a few days' employment for modern equipped works. In the engineering industries, conditions show little variation from recent weeks, few branches being more than moderately active. A few firms hereabouts are encouraged to hope for some business from Russia in the future. The iron and steel market, under existing conditions, is naturally dejected, and little interest has been displayed this week. There has been more than ample accommodation on the floor of the Exchange of recent weeks, and the stojcism of both buyers and sellers has been most marked. There is no confidence in the future of trade, or in the stability of present prices. There are no evidences of improvement in the near future, at any rate, so far as the main industries of this district are concerned.

Raw Iron.

Despite curtailment of output at pig iron furnaces in the Midlands, stocks indicate that supplies of forge and foundry iron are in excess of the demand. Foundries in this district claim to be getting their full share of the work that is available, but the quantity of raw material being used is much below normal. Orders for iron, whether placed with furnacemen direct or with merchants, are for very small tonnages, and relate only to immediate consumptive needs. Even the few fortunate furnacemen whose current sales are reported to exceed their output, do not claim any improvement in general conditions on those existing during the past three months. Other furnacemen have, as previously reported, closed down some of their furnaces, but the effect upon the market is not very noticeable. Production of pig iron in June fell by 22,700 tons, when compared with the previous month, and it is anticipated that a further decline in output will be recorded for this month. The Central Pig Iron Producers' Association continues to control the selling price of iron in this market, but Midland smelters are doing business in open markets at lower figures than they are permitted to accept from Black Country founders. The prices for delivery in this zone are: Northamptonshire foundry, £3 2s. 6d.; forge, £2 17s. 6d.; Derbyshire and North Staffordshire No. 3 foundry iron, £3 6s.; forge, £3 1s. Blast-furnacemen have now no difficulty in securing cheap coke, and it is reported this week that contracts for best Yorkshire furnace fuel could be arranged at 11s. 6d. per ton at ovens. Spot lots are available at even cheaper rates.

Manufactured Iron.

The position in the Staffordshire finished iron trade shows no amendment. Mills are working short time in all departments, the flow of business being very irregular. In branches of the market where there is no recognised basis of prices, there is evident weakness. Many ironmasters complain that prices are unremunerative, and it is only with difficulty and often at a sacrifice that they are able to keep the mills running. Marked bars sell at the fixed figure of £12 per ton at makers' works. Crown iron varies in price according to grade and make. There is no fixed scale in this department, and internal competition is so keen that Staffordshire makers are unable to keep up the level of values which they consider economic. There are one or two firms so favourably placed as to be in a position to turn down orders offered at less than £10 per ton, but there are other firms ready to accept £9 5s. as a means of keeping plant in operation. Common bars for the nut and bolt trade have declined further, and business is reported to have been done this week at £8 7s. 6d., a figure half-a-crown below last week's minimum. Belgian No. 3 iron continues successfully to compete in this market and the bulk of the business goes abroad on the score of price. Wrought iron gas tube strip is still quoted at £10 12s. 6d. delivered. There is a stronger demand for this material, but until makers have a better reserve of orders than they have at the moment, values are not likely to stiffen. Ironmasters will, however, no doubt, take the first available opportunity to increase selling rates.

Steel.

There has been no movement of moment in the steel market in this district during the week. Consumers of structural material having given out the small business they had withheld pending the Association's price decision, have again relapsed into a semi-comatose condition. There is no great amount of work on hand and specifications are of an unsatisfactory character. Steelmasters have difficulty in arranging rolling programmes and steel works are far from fully employed. Values of heavy steel show no change, and are as set out in detail last week. In the half-products department of the market, foreign competition is very keen, but local steelmasters at the moment refuse to lower their prices. For small bars £6 7s. 6d. is the minimum, as is £5 for mild steel billets. Continental joists have been offered in this market at £4 10s. 6d. delivered, sheet bars at £4 7s. 6d., and small bars at from £4 11s. to £4 12s. 6d.

Galvanised Sheets.

There is an improved call for galvanised sheets and increased activity at local mills. There is so much leaway to be made up, however, that competition is very keen, and now that price control has been removed quotations vary according to circumstances. In one or two special cases £9 10s. per ton has been accepted for 24-gauge corrugated sheets for export. The general quotation current is £9 12s. 6d., while a few mills ask up to £9 15s. A better tonnage of orders is coming in from South Africa, and inquiries from the Argentine, Brazil and the West Indies promise improved business. The home market keeps up well, though it is chiefly for small scale requirements. Values in this case are slightly higher.

Metal Tubes and Sheets Reduced.

Prices of rolled and drawn metal in Birmingham have been readjusted to the reaction in the copper market. Strong copper sheets have been reduced from £70 to £64. Rolled brass is reduced to 67s. 8d. per pound. Tubes are down a farthing per pound, making solid-drawn brass 9d., solid-drawn copper 10d., and brazed brass 10¼d.

Satisfactory Results.

Satisfactory trading results were reported at the tenth general meeting of Braithwaite and Co. (Engineers), Ltd., of Crown Bridge Works, West Bromwich. The chairman of the company, Mr. J. H. Humphreys, pointed out that the general depressed condition of industry had resulted in a contraction in the volume of inquiries, and a keen struggle by competing firms for the work available. Owing to the recent extension and re-equipment of its British Works, the company is in a favourable competitive position. In addition to the ordinary run of structural work, it specialises in certain forms of construction. Much attention is being paid to the cultivation of overseas markets. The net profit for the year amounts to £23,634 5s. 8d., as compared with £23,763 14s. 8d. last year. In view of the very difficult conditions which have obtained, there is cause for congratulation in such a result. The profit noted above includes a dividend from Braithwaite and Co. (India), Ltd. This company reports the past year to have been a very difficult one, especially for the structural trade, and points out that the demand for steel work and bridges for Indian railways and Government Departments, which usually absorbs the largest part of the company's output, has been reduced to practically nothing, owing to general financial stringency. Both works operated by the company have, however, worked at full capacity and the volume of orders is satisfactory.

Work for Staffordshire.

In face of severe foreign competition, a contract of a value of approximately £150,000 for the complete electrical equipment of the steel works and rolling mills, which the South African Steel and Iron Industrial Corporation, Ltd., supported by the Union Government, is establishing at Pretoria, has been secured by the English Electric Company, Ltd. The contract, which will be executed at the Stafford works, includes electrical motors aggregating 86,000 horse-power, together with transformers, switchgear and cabling on a corresponding scale.

Black Country and South American Trade.

The Dudley Chamber of Commerce has arranged a conference between Dudley and Black Country manufacturers and traders and Lord Ednam to take place on July 27th, with the object of discussing the possibility of an attack on the South American market. The conference, which will be private, will be attended by representatives of the iron and steel, engineering, wool, glass art metal and other trades, and it is hoped, as a result, to formulate a policy which may bring much new business to the district.

Obituary.

The death has taken place as the result of an accident of Mr. Daniel Hackett, of Beauty Bank, Old Hill, one of the oldest chain manufacturers in the Black Country. Mr. Hackett, who was eighty-one years of age, built up one of the most prosperous concerns of its kind in the Old Hill district. He was the first manufacturer to introduce machines for making chain. The death has also taken place at his residence in Wolverhampton in his eightieth year, of Mr. Harold Holcroft, managing director and chairman of Thomas Holcroft and Son, Ettingshall Foundry, near Wolverhampton. Mr. Holcroft, who had resided in Wolverhampton all his business life, had taken a keen interest in many Midland concerns. He was a director of Ruffords, Ltd., fire-brick manufacturers, Stourbridge; chairman of the Bilston Gas Company, and a director of the Willenhall Gas Company.

Unemployment.

The further slight decrease in the number of unemployed in the Midlands recorded in the latest statistics is welcome. This week's fall of 1000 makes the total 398,573, of whom 248,070 are wholly unemployed, and 149,865 temporarily idle. The position in Birmingham goes from bad to worse, the present figure of 69,835 being an advance on that of the previous week. The unemployment figures in Birmingham are, as a matter of fact, at the highest point since 1922. In the Stoke-on-Trent area unemployment has reached 38,821; at Leicester, 18,187; Nottingham, 17,419; Coventry, 17,068; Wolverhampton, 14,100, and Walsall, 10,707.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Electrification Justified.

THE Manchester South Junction and Altrincham Railway, which is owned jointly by the London, Midland and Scottish Railway and the London and North-Eastern Railway and which, after a life under steam extending over eighty-two years, was electrified at a cost of about £500,000, has been in operation under the new conditions for about ten weeks. On Monday two new stations—one at Dane-road, between Stretford and Sale, and the other at Navigation-road, Altrincham—were opened, making a

total of twelve stations along the line. An official opinion expressed during the past few days is that the increase in passenger traffic has completely justified the change over. Each of the ten stations that have been in operation has shown an increase, and in some instances an important one, and it is anticipated that the two additional stations opened this week will add their quota. The line extends over a distance of about 9 miles and serves important residential areas which are capable of further development.

Oil-engined Omnibuses.

Manchester Corporation Transport Committee has for some time been carrying out a series of experiments with the heavy oil engined omnibus, the present fleet of that type numbering six. It is understood that the Committee is now considering a recommendation to purchase thirty chassis fitted with heavy oil engines, special conditions of guarantee being offered by the makers. It may be recalled that about four months ago Mr. R. Stuart Pilcher, the General Manager of the Transport Department, reported to the Committee that the heavy oil engined vehicle which had been the subject of experiments for several months had resulted in a saving equivalent to about £300 a year. It was on the strength of this that the Transport Committee at that time decided to order additional omnibuses of this type.

On Short Time.

The announcement is made that in consequence of the depressed conditions of the markets the plant of Harrison, McGregor and Co., Ltd., agricultural engineers, of the Albion Ironworks, Leigh, will be closed down alternate weeks until further notice. Altogether something like 500 employees will be affected by the decision.

Non-ferrous Metals.

With the sole exception of spelter, all sections of the non-ferrous metals market during the past week have effected varying degrees of recovery after the general fall reported a week ago. Tin has been the sport of speculative elements and the market view is that the serious decline was due primarily to successful operations by "bearish" interests. To no small extent, also, must the present week's recovery be attributed to a "bull" movement, although, at the same time, appearances seem to be in favour of an improvement in the statistical position of this metal. The demand in the United States is reported to be on a better scale, though so far the improvement has not extended to the markets either here or on the Continent. On balance, tin is roughly £2 a ton higher than a week ago, but still about £6 below the level ruling at the beginning of the present month. From the point of view of the demand the copper situation is little, if any, better than before, and there would appear to be little likelihood of prices moving up much beyond their present level until some, at least, of the very heavy stocks have been absorbed. There has, however, been a partial recovery from the extremely low point reached at one time last week, standard brands having moved up by about £1 a ton. Supplies of lead in sight seem to be somewhat less heavy than they have been at times, and despite a very moderate demand in this section offers have advanced by about 5s. a ton. It is curious that spelter should be 7s. 6d. a ton cheaper in view of the fact that an agreement has been announced by which world producers undertake to reduce the output by 45 per cent. compared with 1929, but the explanation is that some such action had been anticipated for some time and had already been discounted in market values.

Iron and Steel.

On the whole, the iron and steel markets here have had a gloomy week, and the better tone of the pig iron section experienced of late has given way to a return of quiet conditions, with users reverting to small-scale buying operations. The recent slight spurt has been largely a question of replacing stock which had, in many instances, been allowed to get very low, and it is doubtful if foundry trade conditions in Lancashire are more active than they have been during the past three months. Quotations are steady at about 67s. per ton for Derbyshire, Staffordshire, and Cleveland iron, 65s. 6d. for Northants, about 87s. 6d. for Scottish, and 81s. for West Coast hematite, all delivered in the Manchester district. A poor demand for bar iron is being experienced locally, but prices are maintained at £9 15s. per ton for Lancashire Crown bars and about £8 5s. for No. 2 material. There are few bright spots in the steel market. New constructional business of any magnitude is a rarity, although inquiries, chiefly for small jobs, are reported this week to be somewhat more numerous. A little more interest has been displayed in locomotive plates, but sales of these are disappointing still and compare very badly with the position twelve months ago. General plates and bars are all the subject of a quiet demand, and almost immediate delivery is easily secured. Small re-rolled bars are quoted at about £6 10s. per ton, sections at £8 7s. 6d., joists at £8 15s., tank plates at £8 17s. 6d., boiler plates at about £9, and 3in. bars at £9 7s. 6d. The movement of imported materials is restricted to odd parcels and prices in this section are in most instances weak in tendency.

BARROW-IN-FURNESS.

Hematite.

The general tone of the hematite pig iron trade continues to be flat, and there is not a bright spot in it at present. Although prices have been cut, especially in the quotations for delivery at Glasgow, there has been no appreciable increase in demand. The business with the Midlands is less than it was. Continental orders are nothing like what they were, and the tonnage now being shipped is very light. Stocks are not coming down very much where production continues, but at Barrow, where the furnaces are damped down, there is a sign of reduction. It is quite evident that the turning point in trade has not come yet. Iron ore is in quiet demand and likely to be. The tendency as regards foreign ore is to restrict imports, despite the reduction of 2s. a ton in price. The Barrow rail mills are still idle, but at Workington railway material is still being turned out, though in the case of both works fresh orders would be very welcome. Hoops and small sections made at Barrow are experiencing a fair trade. Fuel is in quiet demand.

Shipbuilding.

The P. and O. liner "Strathaird" was launched from Vickers' yard last Saturday. Lord Inchcape, who sailed to Barrow in his steam yacht, attended the ceremony. The "Strathaird" weighed no less than 14,000 tons when she left the stocks, which is a very big weight to launch. It took the great ship forty-five seconds from the first movement to become afloat, but the whole affair passed off without a hitch. This is the last big liner that Vickers have to launch, and there only remain to be constructed four destroyers and two submarines. That means that when the two P. and O. boats are completed there will be a big reduction in the number of employees, which at present total nearly 12,000.

SHEFFIELD.

(From our own Correspondent.)

Position Unchanged.

ALTHOUGH some departments of Sheffield trade may be able to show slight gains, these are offset by losses in other directions, and on balance the general position remains about the same. There has been little real change for a month or more, and in most branches of local industry conditions are very unsatisfactory, with no sign of the revival that has been looked for for so long. Efforts to secure economy in working are continuous. Recently there have been further dismissals of clerks and men in the higher positions, at several of the large and best-known works, and there have also been reductions of salaries and wages, affecting all grades from directors and managers down to errand boys. The number on the roll of the unemployed has increased.

The Heavy Side.

In the open-hearth steel department production is still on as low a scale as ever. There is no new feature in the trade, and one can only repeat that there is a plentiful lack of bulk orders, while small orders come in with just sufficient regularity to keep a meagre proportion of furnaces in operation from week to week without guaranteeing any continuance of activity. The market for basic scrap has shown further weakening, and supplies are now available at 38s. per ton, with buyers offering a shilling less. There is a poor market for the higher qualities of steel scrap, cast iron, and wrought iron. In heavy manufacturing a fair amount of work is in hand on high-pressure steam specialities, but the departments dealing with shipbuilding and railway steel are very poorly employed. There are no heavy engineering contracts on hand, and the call for steel works machinery is at a very low ebb. Reference to the last-named point was made last week at the annual meeting of Davy Bros., Ltd., whose principal customers until recently were the heavy steel works. The chairman said that the board fully recognised the necessity of obtaining work in other directions until such time as the iron and steel works were again in a position to resume purchases, and with that in view they were taking active steps towards obtaining work in directions which, until recently, had been looked upon as outside the direct scope of the company. No time, he said, was being lost in obtaining work to keep the organisation together, and orders received for the first quarter of the new financial year, although inadequate for their requirements, were, in value, over half the value of the orders received during the twelve months ended March, 1931.

Other Branches.

The many new applications of stainless, heat-resisting and acid-resisting steel which have been discovered help to keep that department in a healthy condition, and although further progress appears to have been checked for the present, a large volume of production is maintained. The section dealing with automobile supplies is not so well placed, but it still provides a substantial amount of employment, some makers of springs for motor cars being fairly well off for orders, while the drop forging plants are also moderately active. There is little of a cheering character to be found in the tool trades, apart from the shops devoted to the manufacture of permanent magnets, which are pretty well employed. Files and some branches of the saw trade are seriously depressed. The home demand for engineers' tools is moderate, but export trade has reached a very low level. The buying capacity of our overseas markets continues to fall, and the quantities of special steel being sent abroad are abnormally low. The falling away of the Australian trade is hitting many firms severely.

Sheffield and a New Alloy.

A report from America refers to the introduction of a new alloy of copper with nickel and silicon, and the claim is made that by a dual heat treatment copper can be brought to a hardness beyond that of structural steel without adding any appreciable weight to the alloy. It is not thought that this new material will compete commercially with the steels made in Sheffield. It is pointed out that the hardness comparison is that of structural steel, and that the term "hardness" has no reference to that of a cutting edge, as understood in connection with a file, twist drill, or turning tool. Dr. Percy Longmuir, a distinguished Sheffield metallurgist, who has been interviewed with reference to the matter, remarked that "the comparisons with structural steel are not very evident, and, owing to the initial high price of copper, there would seem to be little prospect of commercial rivalry." He added that "one of the most important properties of copper—that of resistance to corrosion—is not mentioned, and even in this respect it is very doubtful whether the claims made for the new alloy, if substantiated, could meet in competition the structural and other types of stainless steel so largely produced in Sheffield."

Duralumin in Tramcars.

The use of duralumin for several parts of a tramcar is being made the subject of a very interesting experiment by the Tramways Department of Sheffield Corporation. The Department has extensive workshops, in which it now builds all its own car bodies, buying nothing but the heavy chassis. Its usual rate of construction is about thirty per annum, and it now has in progress four cars, three of which are of the standard pattern, while the fourth is the experimental car. The standard cars are interesting, in that aluminium is largely used in their construction. The staircase framing, the dash or screen in front of the driver, the roof panels, side panels, reflectors, and small castings are all of this material. A number of parts are, however, still made of steel or wood, and in the experimental car these parts are being made of duralumin. They will include the whole underframe which fits over the chassis, the driver's platform, the pillars separating the windows, the rails running along the car sides, and the framing supporting the roofs both upstairs and down.

Advantages of Lightness.

The use of aluminium has already considerably reduced the weight of the standard tramcar, and the adoption of duralumin will be a further step in that direction. In the experimental tramcar it has been necessary, in replacing some of the steel work, to use duralumin of larger section, so that the saving in weight is not two-thirds. It is, however, fully one-half, and it is estimated that the total weight of the vehicle, as compared with the present-day standard pattern, will be lessened by 3 tons. This will mean an appreciable saving in running costs. The cost of electrical energy in transporting a car is about £16 per ton per annum, and there will be 3 tons less dead-weight to carry about. There will be less wear and tear of permanent way, less braking energy required, and less noise. On the other hand, the higher cost of the duralumin has to be considered, and the interesting question to be worked out is whether that cost will be balanced by the savings. The experiment is almost the first in this country, and will be watched with much interest.

Cutlery and Plate.

The condition of the cutlery and plate industries continues much the same as recently reported. Apart from contracts for hotels and steamships, there is but a moderate demand for high-class table ware. Large quantities of goods are being produced for coupon distribution. The export trade is very much down, and compares most unfavourably with that of the past two years. For the first six months of this year the total value of cutlery sent abroad was £289,585, as against £431,775 in the corresponding period of last year and £518,963 in 1929. Australia took only £47,164 worth, as against £118,729 and £143,703 respectively. The United States figure was down to £9363, as compared with £35,425 and £42,272; British South Africa fell from £50,077 in 1929 and £40,842 in 1930 to £9115; and the Canadian, New Zealand and Indian trade also showed falls, though not so large in proportion. The June figures amount to a total of £57,449, comparing with £56,036 in May and £71,742 in June of last year. There was a substantial increase in safety razor blades, but decreases in safety razors and all other kinds of cutlery. The Australian purchases were again down, but South Africa, alone among the markets, showed an increase. Imports of cutlery in June reached a value of no less than £135,049, as against £41,000 in May and £67,730 in June, 1930. Of the total, however, cutlery to the value of £88,574 was re-exported, this being a record figure.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

THE Cleveland pig iron market is in a lifeless condition. Holiday influences and the international crisis are having a disturbing effect. Sales are small in volume, and restricted to deliveries over short dates. Nevertheless, the Cleveland ironmasters are still firm in the retention of their fixed minimum prices, and it is a hopeful sign that a few small sales of foundry iron have been effected for export. The Midland makers, like those of Cleveland, have a fixed rate in their own area, but they are delivering iron on the North-East Coast nearly 10s. per ton below their own zone prices. Against this form of competition, Cleveland ironmasters have no protection, but they refuse to be tempted into similar ruinous courses. No. 1 Cleveland foundry iron is 61s., No. 3 G.M.B. 58s. 6d., No. 4 foundry 57s. 6d., and No. 4 forge 57s.

Hematite Pig Iron.

East Coast hematite makers report a little business with consumers in the Sheffield district and the Midlands, and the merchants are understood to have made small overseas sales. The latter have disposed of a little iron to consumers in Italy, and are not without hope of doing business with firms in Holland. As producers have no fixed prices for hematite, terms of contract vary somewhat, but 62s. for ordinary qualities may be given as the basis of market values. Hematite is thus cheap, compared with prices ruling for Cleveland pig iron, but buyers, while acknowledging that quotations cannot be expected to fall much further, are coming forward slowly.

Ironmaking Materials.

The foreign ore trade is dull, and although 15s. is mentioned as a nominal figure for best Rubio ore, a buyer would have no difficulty in placing an order at 14s. 6d. c.i.f. Tees. Blast-furnace coke is abundant and difficult to dispose of, but, while consumers claim they can shade 15s., delivered at the works, sellers are disinclined to acknowledge a lower quotation, and some of them hold out for a higher figure.

Manufactured Iron and Steel.

In one or two branches of the manufactured iron and steel trade inquiries are just a shade better, but actual transactions are still confined to narrow limits. Prices are unaltered.

Shipbuilding Slump.

Another shipyard was emptied on the Tyne this week when Hawthorn, Leslie and Co., Ltd., Hebburn, launched the twin screw motor-tanker "Capsa," built for the Anglo-Saxon Petroleum Company, Ltd., London. The firm, however, has two sloops to lay down for the Portuguese Government. Swan, Hunter and Wigham Richardson, Ltd., Wallsend, is the only other firm on the river which is actively employed on vessels on the stocks, though Palmers' Company is building two British destroyers in its Jarrow yard. Swan, Hunter and Wigham Richardson have two tankers on the stocks at Wallsend, and are constructing a small floating dock. At the Neptune yard, Walker, which has been without work for some time, a cargo vessel is to be built by the firm in order to keep its apprentices employed, and an order for a fast passenger steamer for French owners has just been booked. Apart from the work referred to all that is now proceeding on the river is two or three vessels, which are being completed, and the fitting out of the large liner "Monarch of Bermuda," by Vickers-Armstrongs at the Naval Yard, Walker. Only one shipbuilding yard on the Tees—that of the Furness Shipbuilding Company—is in operation, and several yards on the Wear are closed down. Repair work has also fallen off considerably.

The Coal Trade.

New business for any class of coal is not easy to secure, and the prospects for the remainder of the month are not bright. Trade has fallen to a low ebb, and is principally on home account. Most of the collieries are working only five days a week, and this is evidently sufficient to meet requirements. Lost time is more frequent in Durham than in Northumberland, as nearly all classes of coal in the former county are in very limited demand. Northumberland exists largely on its large steam trade, as there is not much market for smalls, hundreds of thousands of tons of which are lying on the ground. Both counties will feel the effects of the French import restrictions, as nearly every variety of coal was sent to France. They will suffer not only from the direct loss of trade, but by greater competition from other countries that will have a larger surplus of coal for sale and have no retarding minimum prices to consider. Holders of all classes of Northumberland steam coals are pressing supplies on the market, but adhere to fixed minimum prices. New business for August is sparingly indicated. Large kinds are quoted at 13s. 6d., and smalls at 8s. 6d. Durham prime large steams are at 15s., with smalls firm at 12s. There is no bright feature in the Durham gas coal section, and more idle days are imminent at the pits. Best gas are at 14s. 6d., and seconds at 13s. 3d. to 13s. 6d. Coking coals are doing fairly well for smalls, and unscreened have a moderately good trade at the old prices. Bunkers are in slow demand and are offered freely at 13s. to 13s. 6d. There is an accession of strength among foundry cokes. Ordinaries are not now less than 15s. 6d., and it may be that before long they will touch 16s. Production has been reduced and a better demand has been experienced, notably from Scandinavia, despite the large amount of coke available on the Continent. There are ample supplies of blast-furnace coke. Gas coke is quiet, but with rather more inquiry for later dates, and prices are upheld.

SCOTLAND.

(From our own Correspondent.)

Extended Holidays.

OWING to the depression the annual holidays now being observed will be, in most instances, extended until August 3rd, by which date accumulations of orders may permit of a fairly satisfactory resumption.

Fate of Old Scottish Industry.

The last survivor of an old Scottish industry has passed with the closing down of the Wanlockhead lead mine. This mine, which had been in active operation for 200 years, was the last of a group in the district of Leadhills and Wanlockhead. It is known that in 1512 workmen were engaged in lead mining on the Wanlock. In 1680, however, Sir James Stampfield opened the mines at Wanlockhead, and in 1710 these mines were taken over by a company for smelting lead ore with coal. This company entered into partnership with the Friendly Mining Society in the year 1721. In 1906 the present company took over the mines, installing the most up-to-date machinery available. Recently the price of lead has dropped so low that the company decided that it was impossible to carry on, the Wanlockhead mine being the last to give up. The mine may be reopened if the price of lead rises sufficiently to provide a reasonable margin of profit.

Work on the Clyde.

During the second quarter of this year there has been a great decrease in the amount of work on hand in Clyde shipyards. Latest returns indicate that thirty-five vessels of 217,640 tons aggregate are under construction, compared with forty-three of 294,522 aggregate at the end of March last and 100 vessels of 466,304 tons aggregate at the end of June, 1930. Both motor ship and steamship tonnage are affected, the former having been reduced by 44,012 tons and the latter by 33,490 tons since the end of March last, while the amount of new tonnage placed has been exceedingly small.

Steel and Iron.

A fairly good export inquiry for steel and iron products has been reported of late, but with the advent of the holidays business has been unusually light. Prices of steel plates and sections remain unchanged. "Crown" iron also is unchanged at the fixed home rate, but as a rule keen quotations are registered for export specifications. Steel bars are easy for any destination, and black sheets more or less likewise. Galvanised sheets remain slow and for 24-g. corrugated prices slightly under £10 per ton are freely quoted for export. Pig iron prices are unchanged, but business shows hardly any movement, and as heavy stocks are held five furnaces have been damped down, thereby leaving only one in a state of active production. Scrap material is quiet and easy at 49s. 3d. for cast iron machinery and 37s. 6d. per ton heavy steel.

Coal.

The collieries in Fifeshire and Lanarkshire are on holiday, while those in the Lothians have just re-started after closure for the annual holiday. Business in the market, therefore, is practically suspended. Aggregate shipments during the past week amounted to 160,987 tons, against 221,250 in the preceding week and 240,736 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

No improvement has taken place in the steam coal trade of this district during the past week. On the contrary, judging by the returns it almost seems to be still losing ground. According to the statistics of the Great Western Railway Company for the six ports in this Channel under its control, coal shipments last week only came to 372,800 tons, which compared with 396,900 tons for the preceding week and with 511,216 tons for the corresponding period of last year. These figures are certainly not satisfactory, and are, undoubtedly, causing no little amount of anxiety. At the end of last week the loading position was about the worst experienced this year, as the number of idle tipping appliances at the various docks reached as high as sixty, and the situation this week is not a great deal better, as, notwithstanding arrivals of tonnage over the week-end, the number on Monday was forty, and unfortunately chartering operations of late have not been active, and there can be no great hope of the tonnage position being much if any better during the next week or two. The demand from abroad appears to be negligible compared with normal times, and the operation of the new French Government Decree, as from the beginning of next week, which restricts imports of coal, is calculated to have a disturbing effect upon the whole of the continental coal trade. There has, for some time past, been a good deal of talk regarding a reduction of the schedule of minima prices for South Wales coals, and it is quite possible that some foreign buyers have kept their purchases as low as possible in case there should be any change; but it is now understood that the executive committee of the South Wales Marketing Association has decided to adhere to the present schedule, though it is quite possible that some colliery undertakings may seek to have some of their coals reclassified. When it becomes known, however, that no reduction in prices is contemplated, it may be that inquiries which have been deferred will come along, and they will undoubtedly be very welcome. Another question, which has been before the executive committee of the South Wales Marketing Association, relates to the competition of Scotch coals in South Wales. On this point it is understood that, following upon the decision of the executive committee asking for arbitration, an arrangement has been come to by which Scotland will at once frame minimum prices for the gas coals shipped to South Wales. It is stated that it is possible that these prices may permit Scotland to retain business under its control prior to the introduction of the statutory marketing agreement, but that other causes for grievance will be removed. So far as contract operation in Welsh coals are concerned, it is satisfactory to note that the order for 50,000 tons, consisting of two-thirds large and one-third smalls, for account of the Brazilian Central Railways for delivery at Rio de Janeiro during the next two months, has been secured by Gueret, Llewellyn and Merrett, Ltd., of Cardiff, despite the competition of German coals. There is also a rumour that the Egyptian State Railways may place an order for a further 100,000 metric tons of Welsh coals very shortly, though, so far, there is no confirmation of it.

French Import Restrictions.

Reference has been made on several occasions to the report that the French Government intended to re-introduce the system of import licences for coal, patent fuel and coke, in order to curtail the quantities, and so assist the French coal industry. Confirmation was forthcoming at the end of last week when particulars of the Decree came to hand, and from it it is found that the scheme operates from the 20th inst. in respect of land-borne coal, and from the 27th inst. in respect of sea-borne coal, while for coke the system comes into force from September 1st. To give effect to the new system a special Licensing Bureau is to be set up in Paris which will be controlled by a committee composed of two coalowners, two miners, two coal consumers, one representative of the Maritime Chambers of Commerce and two Members of the Chamber of Deputies. The purpose of the system is to ensure that imports of coal into France shall not exceed the average of the years 1928, 1929 and 1930, less 20 per cent. Exports of coal from this country to France have fallen this year very considerably. Compared with the first half of 1930, shipments from the United Kingdom have declined about 27 per cent. and from South Wales by about 33 per cent. It is, of course, quite impossible to say at the present time what, precisely, will be the effect of the new Decree. It all depends upon how permits come through for supplies, but hopes are entertained that South Wales will not suffer any additional loss of orders. In some quarters the belief is even held that this district may, possibly, benefit; but, in any event, the substantial curtailment of imports of Belgium, Dutch and German coals into France will mean that those countries will have to find an outlet elsewhere than France for their production, which means increased competition in other directions for this country, or else materially cut down outputs.

Traffic Returns.

The Great Western Railway Company's returns of sea-borne traffic in respect of the six docks in South Wales under its control were very satisfactory for the four weeks ended July 5th last, inasmuch as the total was the highest for any previous monthly period of this year. Imports came to 330,424 tons, and exports 2,071,114 tons, a total of 2,401,538 tons, which, however, compared with 2,542,396 tons for the corresponding period of last year. The aggregate of trade for the whole of this year to July 5th, just over half the year, is not at all favourable when set against the figures for the same period of 1930. The total of imports and exports comes to 14,285,173 tons, as against 19,020,662 tons for the same period of last year, so that there has been a reduction of no less than 4,735,489 tons, and of this decline it is to be noted that in respect of coal and coke the falling off has amounted to the large figure of 3,783,364 tons.

Coalfield Items.

The strike trouble at the Bedwas Navigation Colliery has come to an end. A meeting of the men held on Friday in last week decided to resume work immediately on the advice of the South Wales Miners' Federation executive, and in, view of an assurance having been given by the South Wales Coalowners' Association that an agreement previously made for the reopening of the colliery will be adhered to, and that matters in dispute will be dealt with by the Conciliation Board. On Tuesday of this week, about 1000 men at two of the Blaenavon collieries became involved in a dispute concerning the minimum wage affecting seven of their number and returned to their homes, their intention being to hold a mass meeting to consider the situation later.

Current Business.

There has been very little fresh business on the market during the past week, either for prompt loading or for delivery over a period. The tone in all sections of the steam coal market is quiet, and stocks generally are very excessive. Some of the collieries producing second Admiralty qualities and Monmouthshire coals are fairly well off, but in other directions business has been very poor, and numerous stoppages of pits are reported. Coke is about steady, but the demand for patent fuel is quiet. The same applies to pitwood, which is quoted about 21s. 6d. to 21s. 9d.

THE IRON AND STEEL INSTITUTE.

THE autumn meeting of the Iron and Steel Institute will be held at Swansea from Tuesday, September 29th, 1931, to Friday, October 2nd, 1931. On Tuesday, at 10 a.m., a general meeting will be held in the Rooms of the Royal Metal Exchange. The Mayor of Swansea (Councillor J. Miller, J.P.) will welcome the members. The chairman of the Siemens Steel Association and of the Welsh Plate and Steel Manufacturers' Association, will also extend a welcome, after which, a selection of papers will be read and discussed. At 1 p.m. the members and their ladies will be entertained to luncheon at the Drill Hall, Swansea, by invitation of the British (Guest, Keen, Baldwins) Iron and Steel Company, Ltd. From 2.30 p.m. to 6 p.m. visits will be paid to Port Talbot and the Morgan Works of the British (Guest, Keen, Baldwins) Iron and Steel Company, Ltd. A reception and dance will be given at 8.30 p.m. in the Drill Hall by the Mayor of Swansea. On Wednesday and Thursday, at 10 a.m., general meetings will be held in the Rooms of the Royal Metal Exchange, when selected papers will be read and discussed.

On Wednesday, members and their ladies will be entertained to luncheon in the Drill Hall by invitation of Baldwins, Ltd., at 1 p.m. From 2.30 p.m. to 6 p.m. alternate visits will be paid to the King's Dock Tin-plate Works (Baldwins, Ltd), Swansea, and the Grovesend Steel and Tin-plate Company, Ltd., at Gorseinon. At 7.30 p.m. a banquet will be held in the Drill Hall, Swansea, by invitation of the Siemens Steel Association and the Welsh Tin-plate Manufacturers' Association. On Thursday, October 1st, the members and their ladies will be entertained to luncheon in the Drill Hall by invitation of the Anglo-Persian Oil Company, Ltd., and the National Smelting Company, Ltd. From 2.30 p.m. to 6 p.m. visits will be paid to the National Oil Refineries of the Anglo-Persian Oil Company, Ltd., at Llandarey, and alternatively to the Swansea Vale Spelter Works of the National Smelting Company, Ltd., Swansea. A Welsh musical evening will be arranged for 8.15 p.m. On Friday, a party limited to fifty will leave Swansea for Newport at 8.50 a.m. to visit the Courtybella Works of the Whitehead Iron and Steel Company, Ltd. For the visitors remaining in Swansea a motor tour will be arranged over the Brecon Beacons into Mid-Wales, returning through the Towy Valley to Carmarthen and back to Swansea. The local Reception Committee will make alternative arrangements for the entertainment of the ladies during the afternoons of Tuesday, Wednesday and Thursday.

A MEETING of the Conference on Electricity Supply in Rural Areas was held on July 14th, at the offices of the Electricity Commission. Consideration was given to a summary of the action taken by the Commissioners, authorised electricity undertakers, and others since the date of the last meeting of the Conference—July, 1930—with a view to stimulating the development of the supply of electricity in rural areas. The principal matters discussed were reports as to the progress made with the Bedford and Norwich Demonstration Schemes, and the preparation of a Standard Wayleave Agreement. The meeting was adjourned until a date to be fixed in October next.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	16/- to 20/6
(1) Spanish	14/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	15/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 10 0	—
No. 1 Foundry	3 13 6	—
No. 3 Foundry	3 11 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 2 0	3 2 0
No. 1	3 2 6	3 2 6
Cleveland—		
No. 1	3 1 0	3 1 0
Siliceous Iron	3 1 0	3 1 0
No. 3 G.M.B.	2 18 6	2 18 6
No. 4 Foundry	2 17 6	2 17 6
No. 4 Forge	2 17 0	2 17 0
Mottled	2 16 6	2 16 6
White	2 16 6	2 16 6
MIDLANDS—		
(e) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 1 0	—
„ „ Foundry	3 6 0	—
(e) Northampton—		
Foundry No. 3	3 2 6	—
Forge	2 17 6	—
(e) Derbyshire—		
No. 3 Foundry	3 6 0	—
Forge	3 1 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	3 15 6 (*a*) / 4 0 6 (*b*) / 4 5 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 10 0	—
Best Bars	11 0 0	—
Double Best Bars	11 10 0	—
Treble Best Bars	12 0 0	—
LANCS.—		
Crown Bars	9 15 0	—
Second Quality Bars	8 5 0	—
Hoops	12 0 0	—
S. YORKS.—		
Crown Bars	9 15 0	—
Best Bars	10 15 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 7 6	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 7 6 to 9 0 0	—
Gas Tube Strip	10 12 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 10 0	10 0 0
Ship Plates, ¾in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	7 10 0 to 7 15 0	8 0 0
Sheets (Gal. Cor. 24 B.G.)	11 7 6 10 0 0	to 10 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 15 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 10 0 to 9 0 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	6 10 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 0 0	—
SHEFFIELD—		
Siemens Acid Billets	9 2 6 (basis)	—
Hard Basic	8 2 6 and 8 12 6	—
Intermediate Basic	6 12 6 and 7 2 6	—
Soft Basic	6 0 0	—
Hoops	9 10 0 to 9 15 0	—
Soft Wire Rods	7 15 0	—
MIDLANDS—		
Small Rolled Bars	6 7 6 to 7 0 0	—
Billets and Sheet Bars	5 0 0 to 5 15 0	—
Galv. Sheets, f.o.b. L'pool	9 10 0 to 10 5 0	—
(2) Staffordshire Hoops	9 10 0	—
(d) Angles	8 7 6	—
(d) Joists	8 15 0	—
(d) Tees	9 7 6	—
(d) Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14 f.o.b.	13/6 to 13/9
Block Tin (cash)	111 15 0
„ (three months)	113 15 0
Copper (cash)	34 12 6
„ (three months)	35 7 6
Spanish Lead (cash)	12 17 6
„ „ (three months)	13 0 0
Spelter (cash)	12 8 9
„ (three months)	12 18 9
MANCHESTER—	
Copper, Best Selected Ingots	37 0 0
„ Electrolytic	38 5 0
„ Strong Sheets	66 0 0
„ Tubes (Basis Price), lb.	0 0 10½
Brass Tubes (Basis Price), lb.	0 0 9½
„ Condenser, lb.	0 0 11½
Lead, English	14 7 6
„ Foreign	13 0 0
Spelter	12 17 6
Aluminium (per ton—raw ingot)	£85

FERRO ALLOYS.

Tungsten Metal Powder	1/11½ per lb.	
Ferro Tungsten	1/8½ per lb.	
	Per Ton.	Per Unit.
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 0 0	7/-
„ „ 6 p.c. to 8 p.c.	£20 12 6	7/-
„ „ 8 p.c. to 10 p.c.	£19 17 6	7/-
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£30 0 0	10/-
„ „ „ 1 p.c. carbon	£34 0 0	12/-
„ „ „ 0·70 p.c. carbon	£36 0 0	14/-
„ „ „ carbon free	9¾d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 0 0 for home	
„ „ „	£11 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£10 10 0 scale 5/- per unit	
„ „ 75 p.c.	£15 0 0 scale 7/- per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170	
Ferro Cobalt	8/9 per lb.	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/6
„ „ Ell	14/-
„ „ Splint	14/6 to 16/-
„ „ Trebles	12/-
„ „ Doubles	11/6
„ „ Singles	10/6 to 10/9
AYRSHIRE—	
(f.o.b. Ports)—Steam	12/9
„ „ Jewel	17/-
„ „ Trebles	12/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/6 to 12/6
Screened Navigation	16/6 to 17/6
Trebles	12/- to 13/-
Doubles	11/6
Singles	10/9
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/-
Secondary Steam	10/6
Trebles	12/-
Doubles	12/-
Singles	10/6 to 10/9

ENGLAND.

	Inland.
(8) N.W. COAST—	
Steams	20/-
Household	30/- to 51/-
Coke	20/- to 20/6
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/-
Steam Smalls	7/6 to 8/-
Unscreened	12/6 to 13/-
Household	27/- to 39/-
DURHAM—	
Best Gas	14/6
Second	13/3 to 13/6
Household	25/- to 37/-
Foundry Coke	24/-
SHEFFIELD—	
Best Hand-picked Branch	24/6 to 25/6 —
Derbyshire Best Bright House	19/- to 20/- —
Best House Coal	18/6 to 20/- —
Screened House Coal	17/- to 18/- —
„ „ Nuts	14/6 to 15/- —
Yorkshire Hards	15/- to 16/6 —
Derbyshire Hards	15/- to 16/6 —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	6/- to 7/6 —
Smalls	4/- to 5/6 —
Blast-furnace Coke (Inland)	12/3 on rail at ovens
Furnace and Foundry Coke (Export), f.o.b.	13/- to 14/-

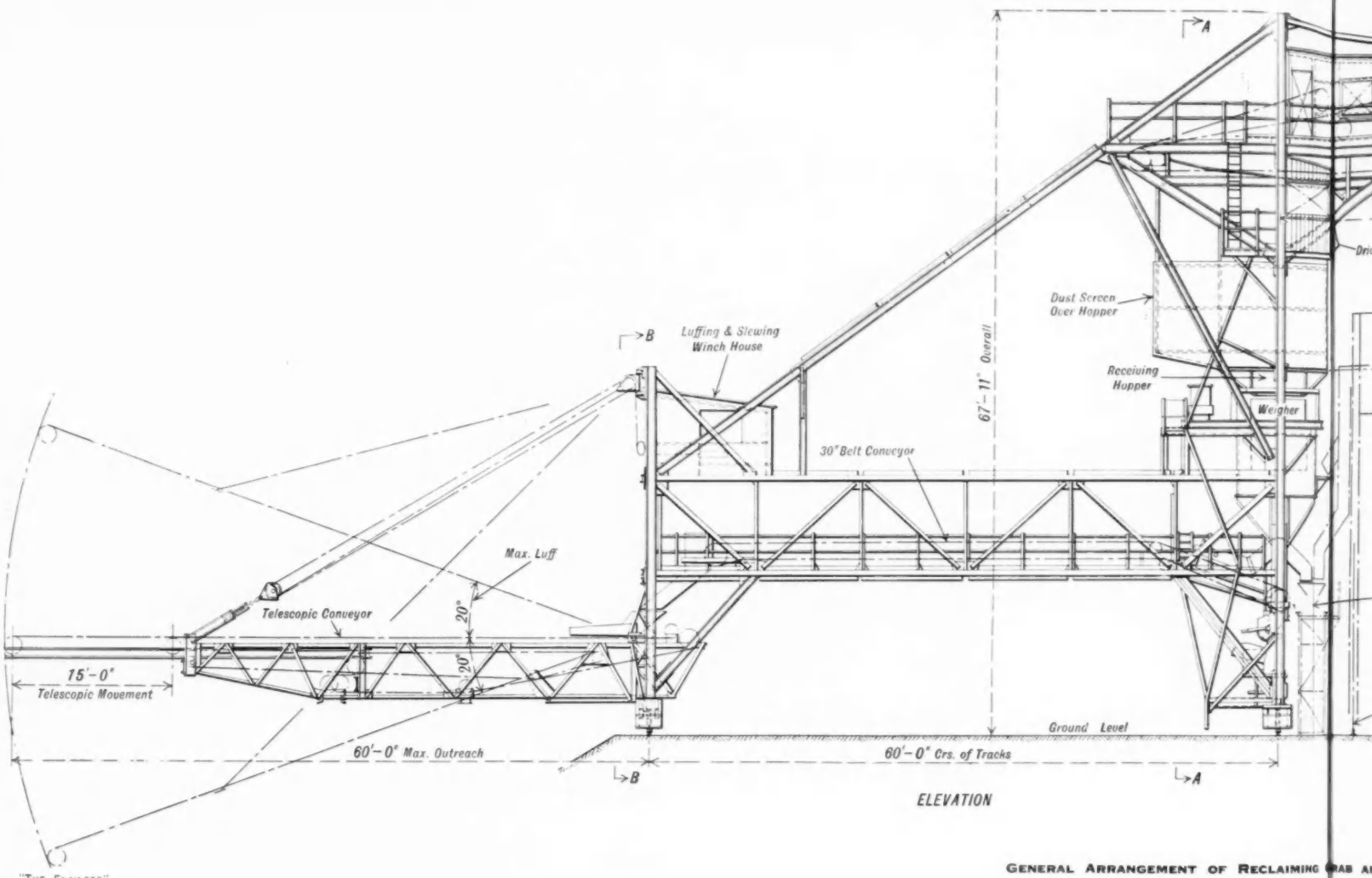
(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	20/-
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 19/3
Ordinary Dry Large	17/9 to 18/-
Best Black Vein Large	18/3 to 18/9
Western Valley Large	18/- to 18/6
Best Eastern Valley Large	17/9 to 18/-
Ordinary Eastern Valley Large	17/9 to 18/-
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	11/- to 13/-
Washed Nuts	18/- to 21/-
No. 3 Rhondda Large	19/9 to 20/-
„ „ Smalls	15/- to 16/-
No. 2 „ Large	17/- to 17/3
„ „ Through	15/6 to 16/-
„ „ Smalls	14/- to 14/3
Foundry Coke (Export)	22/- to 36/6
Furnace Coke (Export)	16/6 to 17/6
Patent Fuel	20/- to 20/6
Pitwood (ex ship)	21/6 to 21/9
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	35/- to 37/6
Seconds	27/- to 31/6
Red Vein	22/6 to 27/6
Machine-made Cobbles	41/6 to 45/-
Nuts	40/- to 46/-
Beans	24/9 to 28/3
Peas	21/- to 21/9
Breaker Duff	8/6 to 9/6
Rubbly Culm	8/6 to 9/-
Steam Coals:	
Large	20/- to 20/6
Seconds	18/- to 20/-
Smalls	11/6 to 13/-
Cargo Through	16/- to 17/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate: Joists (minimum), 22/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 15/- if home consumers confine purchases from associated British Steel Makers. (e) Delivered Black Country Stations.

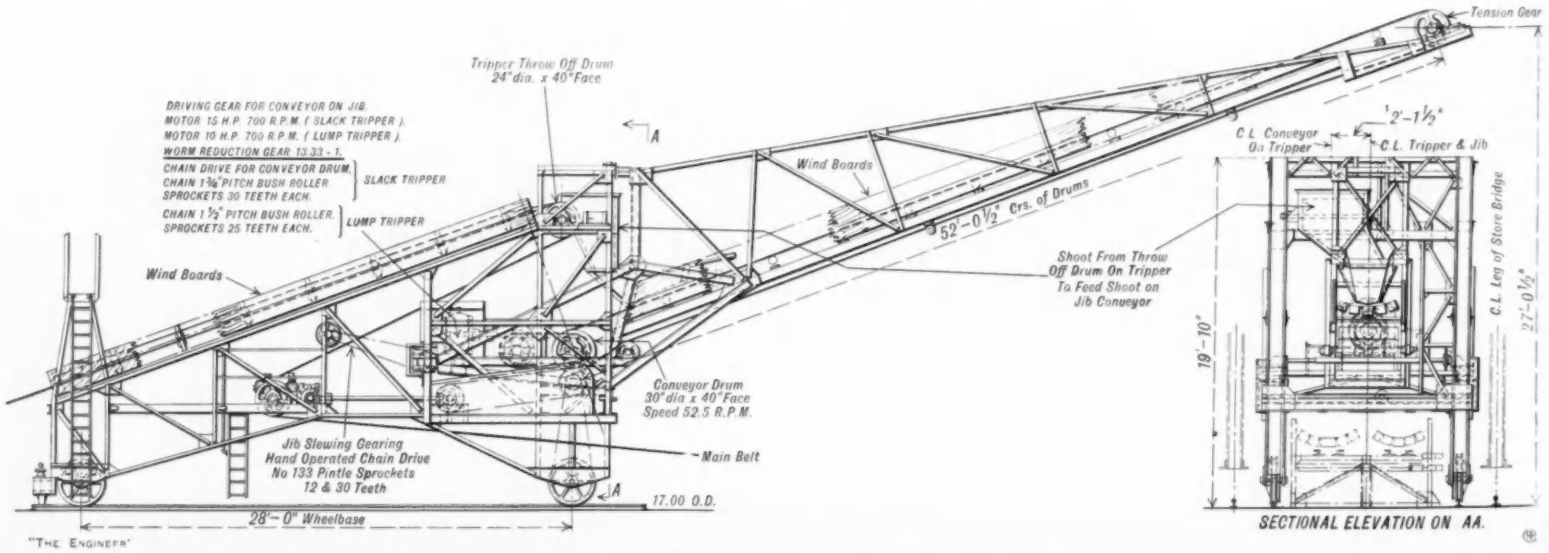
COAL HANDLING PLANT NEAR SHANGHAI FOR

MITCHELL CONVEYOR AND TRANSPORTER CO



"THE ENGINEER"

GENERAL ARRANGEMENT OF RECLAIMING GRAB A


Tension Gear
Tripper Throw Off Drum 24"dia. x 40"Face
DRIVING GEAR FOR CONVEYOR ON JIB.
MOTOR 15 H.P. 700 R.P.M. (SLACK TRIPPER).
MOTOR 10 H.P. 700 R.P.M. (LUMP TRIPPER).
WORM REDUCTION GEAR 13.33 - 1.
CHAIN DRIVE FOR CONVEYOR DRUM.
CHAIN 1¾" PITCH BUSH ROLLER SPROCKETS 30 TEETH EACH. SLACK TRIPPER
CHAIN 1½" PITCH BUSH ROLLER SPROCKETS 25 TEETH EACH. LUMP TRIPPER
Wind Boards
Jib Slewing Gearing Hand Operated Chain Drive No 133 Pintle Sprockets 12 & 30 Teeth
Conveyor Drum 30"dia x 40"Face Speed 52.5 R.P.M.
Main Belt
17.00 O.D.
28'-0" Wheelbase
Wind Boards
52'-0½" Crs. of Drums
Shoot From Throw Off Drum On Tripper To Feed Shoot on Jib Conveyor
2'-1½"
C.L. Conveyor On Tripper
C.L. Tripper & Jib
C.L. Leg of Store Bridge
19'-10"
27'-0½"
SECTIONAL ELEVATION ON AA.

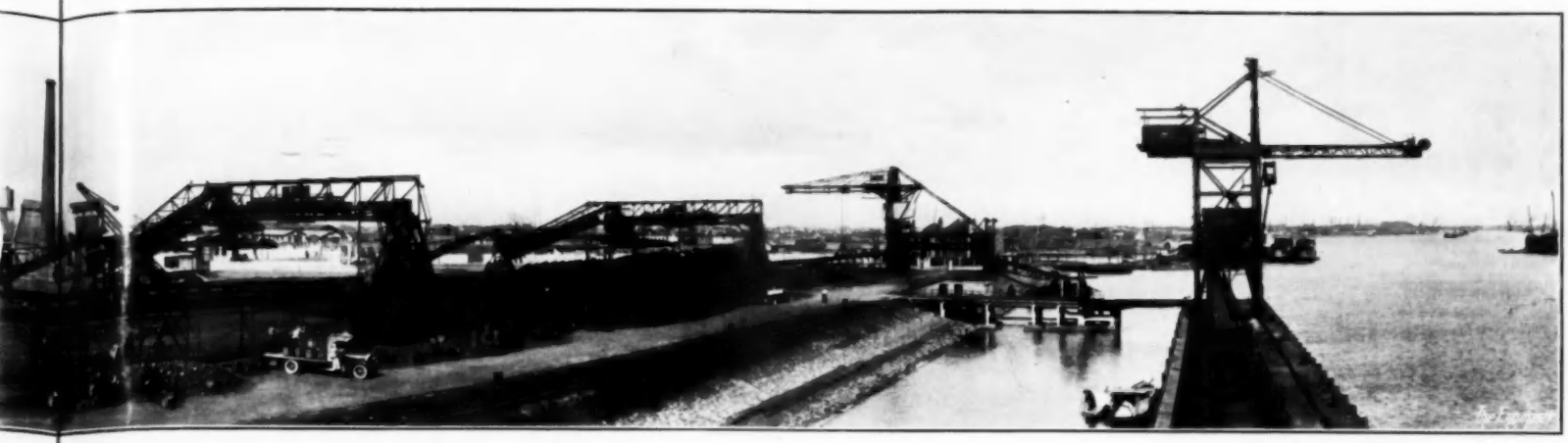
"THE ENGINEER"

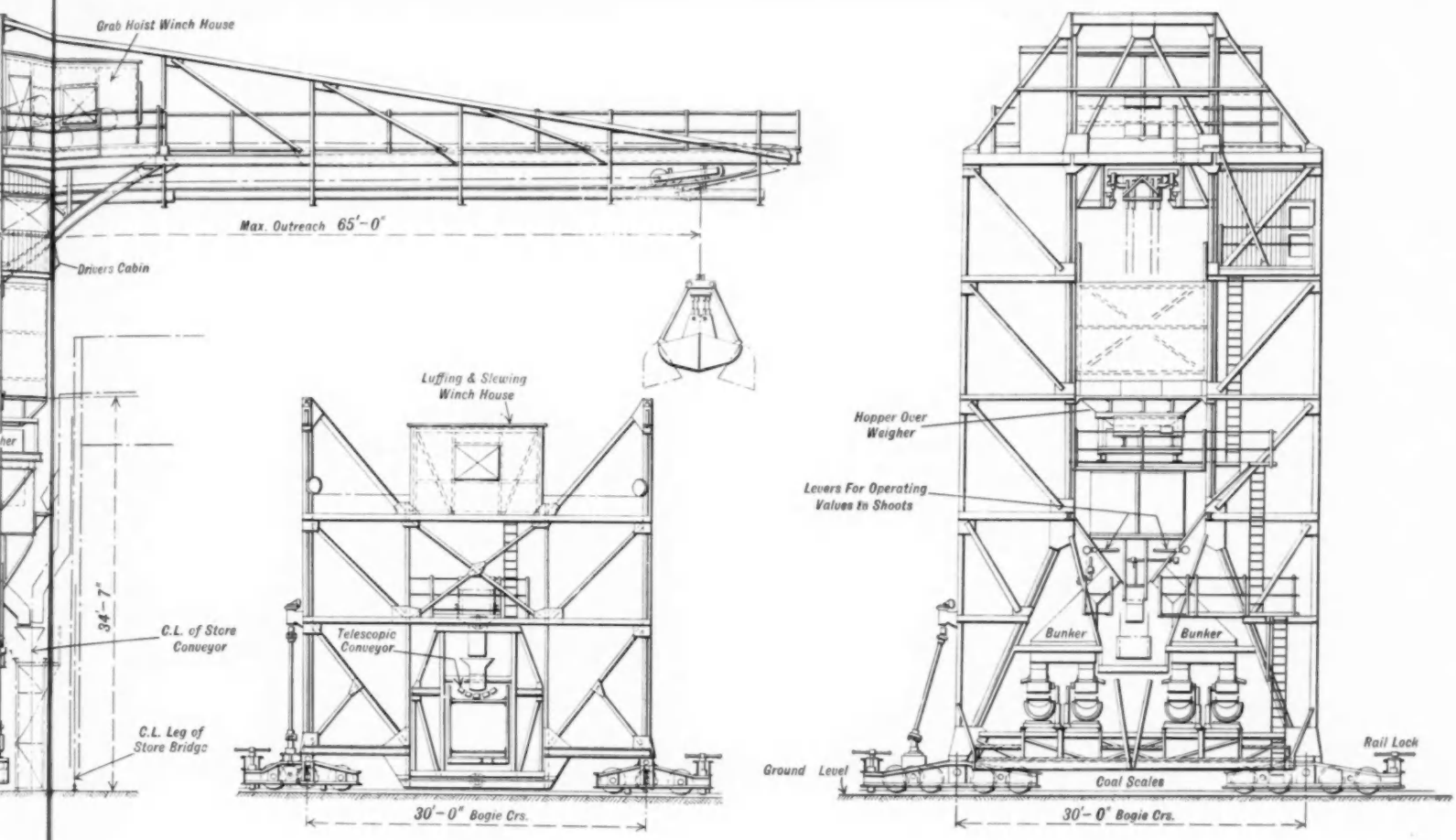
TRIPPING AND LOADING MACHINE FOR MAIN DISTRIBUTING BELT

UNIV. OF MICH.

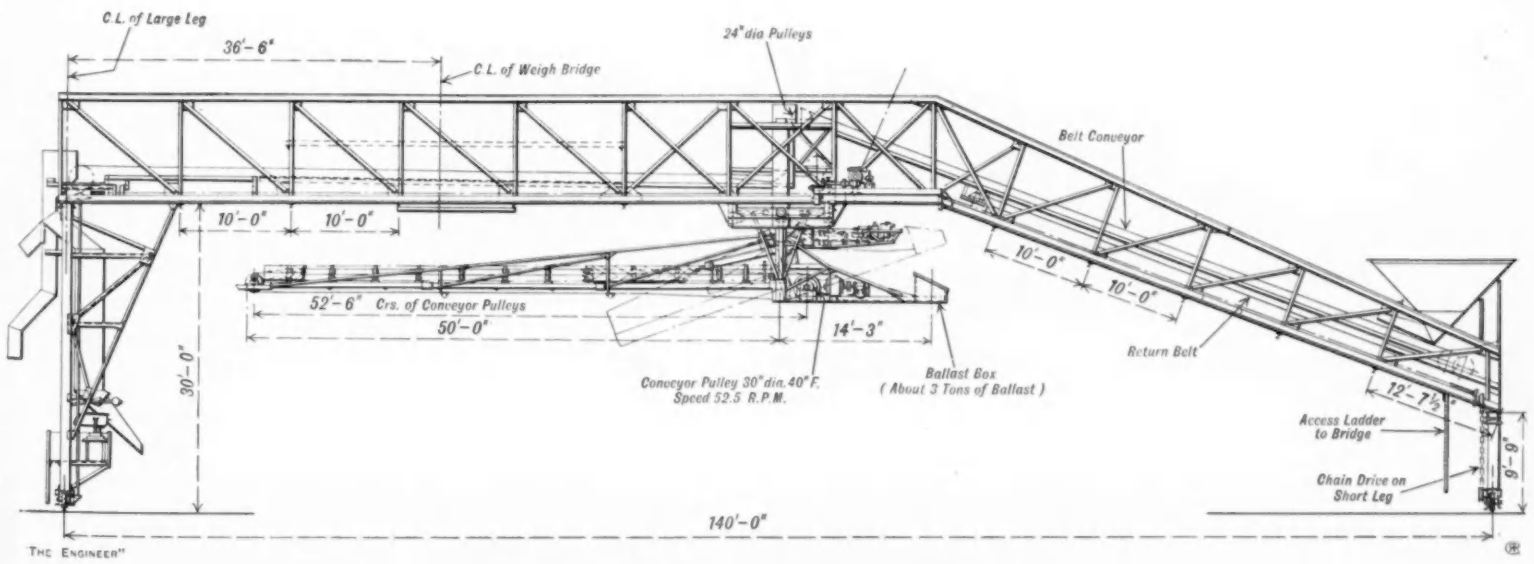
AI FOR THE KAILAN MINING ADMINISTRATION

SPORTER COMPANY, LTD., LONDON, ENGINEERS





LIMING GRAB AND TELESCOPIC ISSUING CONVEYOR



BRIDGE AND RADIAL CONVEYORS FOR DISTRIBUTING COAL

French Engineering Notes.

(From our own Correspondent in Paris.)

Public Works.

THE primary aim of the national programme of public works was to make use of German reparations for the carrying out of all kinds of undertakings that would extend the country's industrial and commercial resources. The reconstruction of the devastated areas had already considerably increased the productive capacity of collieries, works and factories, and as a supply of German material offered the only means of completing what was due for reparations, it was decided to continue this work of economic development by means of harbour works, hydro-electric installations, inland waterways, roads, railways, and shipping, with the particular object of diverting international traffic through France by providing ample docking facilities and direct transport between Channel, Atlantic and Mediterranean ports and Central Europe. The work was carried out methodically until the Young plan reduced the quantity of German material available for reparations, and the Government had to make arrangements to provide for the deficiency. Although public funds were declared to be available for a continuance of the plan, very little has been supplied by the Government, and the works have been practically at a standstill pending a vote by Parliament of the money required to complete them. Now, for the time being, the scheme has collapsed under the Hoover moratorium, at a moment, too, when the character of the programme has changed in the sense that it is no longer a purely development work, but has become a means of eliminating the spectre of unemployment. Public undertakings have hitherto been mainly responsible for the country's relative prosperity, and the effects on unemployment of their partial stoppage have been retarded by the withdrawal of foreign labour, so that French operatives have only recently begun to suffer from the declining activity. The German moratorium has darkened the outlook to an extent that compels the Government to do all it can to save the situation and prevent the rot of unemployment. That explains the French resistance to the Hoover moratorium. In any case, there is less confidence in the future of reparations, and proposals are made for a great national loan to permit of the programme being carried out in full, but as a financial undertaking it is feared that it will not make a ready appeal to the public.

The Steel Cartel.

The decision of German steel makers to postpone the meeting of the Steel Cartel, which was to have been held in Brussels last week, is a further depressing factor in the steel trade. It was hoped that the meeting would have settled the differences that exist between the Belgians on the one hand and the French and Luxemburg producers on the other, so far as concerns the limitation of imports and the Belgian claims to a larger quota. But even though it were found impossible to reach an agreement, as seemed likely in view of the stand taken by the Belgian steel makers, it was, at all events, probable that the Cartel would have been prorogued for another month in order to allow of negotiations being continued. Failing that, the Cartel will cease to exist at the end of the month. The Germans can, obviously, do nothing at the present moment, as they do not know what will happen to themselves. It is true that, in the present state of affairs, the Cartel can do little when its object is to limit a production which will presumably be still further reduced by a falling consumption ; but it has a certain moral effect which would have been strengthened by its being associated with international sales comptoirs, and if that moral influence ceases, and the steel trade is left to itself, there will be a complete disorganisation of the industry, with a disorganised market. There is still a chance that some way may be found of keeping the Cartel alive beyond the end of the month.

Coal Import Licenses.

The Government has unexpectedly put into operation the system of import licenses for coal at a time when it was believed that Parliamentary sanction would be required in view of possible complications and the opposition it encounters from all classes of consumers. The action is justified by the Government on the ground that it is an "exceptional and temporary measure," intended to adjust what is described as an abnormal state of things. The imports are, it is officially explained, increasing at a time when the consumption has declined by 10 per cent. and when the home colliery industry is threatened with the closing of pits and extensive unemployment, because coalowners cannot get rid of their heavy stocks. So far as unemployment is concerned, that would exclusively affect foreign labour. It is hoped that a restriction of imports will enable French collieries to work full time. Licenses for coal imported by rail were required on and after Monday last, and for coal imported by sea the system will come into operation on Monday next.

Trade with Russia.

Until about eighteen months ago the imports from Russia appeared to be so much in the nature of dumping that the French Government decided to restrict them by means of licenses. The Russian Government immediately retaliated by prohibiting imports from France. There were some products, such as oil, which the French were obliged to take from Russia, and although the imports have fallen to a quarter of what they were before licenses were imposed, the total is still large. The French, on the other hand, have sent nothing to Russia at all. French manufacturers, therefore, seem to have suffered most. Negotiations have been in progress for some time past between the two countries for a resumption of normal relations, and they have now agreed to remove trade restrictions pending negotiations for a treaty of commerce. This treaty will be awaited with interest, for it is certain that, if each country concedes what the other claims, it will imply a change in the methods adopted by the Soviet Government in its commercial relations abroad. The French will not accord advantages without guarantees and reciprocity.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

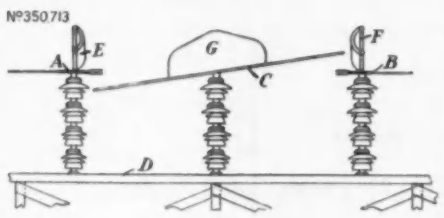
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application ; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

SWITCHGEAR.

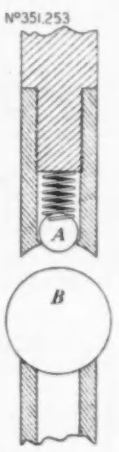
350,713. June 4th, 1930.—CIRCUIT INTERRUPTING APPARATUS OR SWITCHES, *Associated Electrical Industries, Ltd., of Bush House, Aldwych, Westminster.*

This is a lengthy specification, which enters into theoretical considerations that cannot be dealt with here, but briefly one of the objects of the inventors is "to provide a means of increasing the line potential which a switch of given dimensions is able to withstand when employed to isolate an electric circuit connected to a source of electromotive force from a circuit which is unenergised." The switch shown comprises a line terminal A



and a load terminal B supported on insulating pillars. The bridging member C is supported on a centre pillar. In order to ensure that the capacitance between the bridging member and the framework D shall be small relative to that between the bridging member C and the terminals A and B, capacitance areas which may comprise metallic sheets or screens E, F and G of substantial area are conductively mounted on the members as shown. In order to avoid unnecessary corona loss at high potentials the members E F G are formed so that no point on their surface exposes a sharp edge or has a radius or curvature smaller than a predetermined value.—*June 18th*, 1931.

351,253. June 26th, 1930.—ELECTRIC SWITCHES OR CIRCUIT BREAKERS, George Ethelbert Whitehead and Whitehead's Electrical Inventions, Ltd., both of 102, St. Mary-street, Cardiff.

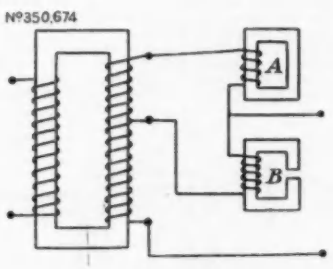


According to this invention an "arcing tip" associated with the main contacts of an electrical switch or circuit breaker comprises a spring-pressed ball A in a cage and adapted for limited outward movement, the arrangement being such that, when the main contacts are in engagement, the arcing ball is engaged by the co-operating main contact B or by an auxiliary contact consisting of a conducting surface attached to or associated with the co-operating main contact, and is depressed a short distance in its cage. When the main contacts separate the spring presses the ball outwards and the contact is finally broken at the surface of the ball, which, it will be understood, is an inexpensive item which can readily be renewed.—*June 25th*, 1931.

TRANSFORMERS AND CONVERTERS.

350,674. May 8th, 1930.—MEANS FOR VOLTAGE REGULATION IN ALTERNATING-CURRENT SUPPLIES, Robert Ironside Bagnall, of 143, Hither Green-lane, London, S.E. 13 ; and Foster Engineering Company, Ltd., of Apex Works, Morden-road, Wimbledon, London, S.W. 19.

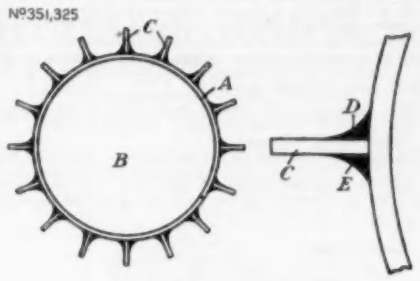
In carrying this invention into practical effect as for the purpose of compensating the voltage drop arising in cables and transformer windings, use is made of a transformer having tappings capable of giving electrical pressures above and below that required in the consumption circuit which is connected, on the one hand, directly to one end of the transformer winding and, on the other hand, through the two dissimilar chokes to the tappings on the transformer winding. In the example shown the choke coil connected to the tapping point of excess pressure



preferably has a closed circuit core A which saturates at relatively low current values, whilst the other choke coil B connected to the tapping point of lower electrical pressure possesses a lower magnetic induction, its core preferably being gapped or discontinuous in order to assist in procuring the required characteristic. The two choke coils may be regarded as arranged in series and bridged across the tappings of the transformer, the potential of the load circuit being determined by the voltage existing at the point common to the two choke coils. At no load the choke of high induction absorbs a certain part of the pressure between the tappings, but as the current increases the voltage of the choke of low magnetic induction increases more rapidly than the voltage of the choke of high induction by an amount which may be arranged to compensate for the drop of pressure occurring in the cables and transformer windings.—*June 18th*, 1931.

351,325. September 2nd, 1930.—COOLING OF OIL TANKS FOR ELECTRICAL APPARATUS, Siemens-Schuckertwerke Aktiengesellschaft, Berlin-Siemensstadt, Germany.

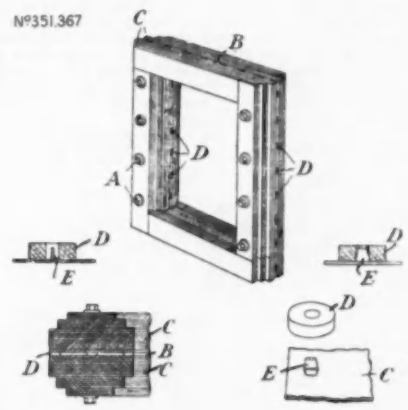
The drawing shows the invention applied to a small transformer tank. The tank consists of a circular wall A of sheet metal, and a bottom B. The novelty of the arrangement in this case is that sheet metal strips C proceeding in the direction of the tank axis are welded on as cooling ribs at different places approximately uniformly distributed over the circumference. The welding seams D and E are made so that the conducting cross



section, which is available for the conduction of heat, is large enough, even taking into account the somewhat lessened conductivity of a welding seam, to supply the quantity of heat which can be dissipated from the whole surface of the cooling ribs. Since, owing to the welding process, a welded joint is also formed to a certain degree at the place where the sheet metal C abuts against the sheet metal A, the removal of heat is equal to that with a casing cast in one piece with the ribs. The invention is also applied to oil tanks in which the wall of the tank consists of deeply drawn corrugated sheet, in which oil-filled cooling ribs are provided.—*June 25th*, 1931.

351,367. October 21st, 1930.—MAGNETIC CORES FOR ELECTRICAL INDUCTION APPARATUS, *The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C. 2.*

The magnetic core described in this specification is suitable for transformers, &c., and is built up of superposed sheets of magnetic material which may be insulated from each other by the scale formed on their surfaces during an annealing process before they are assembled. The sheets or laminations are held together in assembled relation by bolts A, which may be of insulating material to avoid short circuiting of the laminations. A duct B through the interior of the core is formed by separating two of the inner laminations C, which are spaced apart by small insulating spacers D. Each spacer is in the form of a small disc or button with a central aperture which fits over a tongue E, cut or punched along the side edges and outer end from one of the sheets C and bent along its inner end to project integrally and at substantially a right angle from the sheet. The tongues E may, of course, be formed on either one or both of the lamina

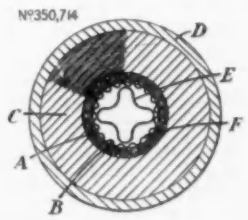


tions C. Each of these tongues is preferably tapered slightly toward its outer end, which is preferably slightly narrower than the diameter of the bore or aperture in the spacer, the inner end or base of the tongue being slightly wider than the aperture in the spacer so that the spacer will be held firmly in place when pressed over the tongue and against the surface of the lamination C surrounding the tongue. The spacers D, with their supporting tongues, should be spaced closely enough to prevent such bulging of the laminations C as to restrict the duct. The length of each tongue E should be less than the thickness of the spacer D, so that it cannot short circuit the two laminations C, and cause objectionable circulating eddy currents. The magnetic core of a transformer or other piece of induction apparatus is frequently earthed, and it may be desirable in some cases to form one or more of the spacers D of conductive metal, so that the whole core may be earthed by a single external earth connection. If more than one spacer is of conductive material, however, it is desirable that they be widely separated to avoid objectionably large eddy currents.—*June 25th*, 1931.

TRANSMISSION OF POWER.

350,714. June 4th, 1930.—ELECTRIC CABLES, Callender's Cable and Construction Company, Ltd., of Hamilton House, Victoria Embankment, London, E.C. 4 ; and John Francis Watson, of "Preston Lea," Woolwich-road, Abbey Wood, Kent.

In electric cables comprising insulating material—for instance,

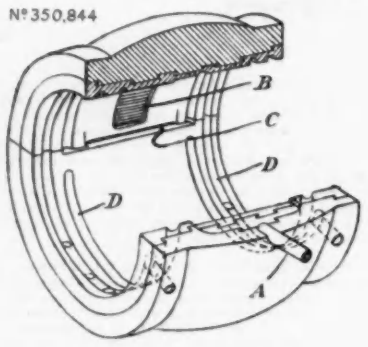


paper—which is impregnated with a liquid or semi-liquid material—for instance, oil or a compound of oil and resin—variations of temperature produce substantial changes in volume

of the impregnating liquid which are liable to result in the permanent enlargement of the lead sheath by the increase in volume and pressure associated with a rise in temperature, so that when the temperature falls again more or less vacuous spaces are formed within the cable. The improved cable described in this specification consists of a conductor A made up of wire stranded together so as to include a central space, within which an elastic body is contained together with a small amount of impregnating material surrounding the elastic body in the spaces, such as B. The conductor is surrounded with impregnated insulating material C, and the whole is enclosed in a lead sheath D. The inner wall of the elastic body is indicated by E and the outer wall by F. Each wall is made of a shape which is readily deformable under pressure. The outer envelope may be in the form of a tube enclosing within it a line of elastic bodies which may be separated or joined together. Alternatively the outer enclosure may be made in short lengths to include one or more of the inner bodies.—*June 18th*, 1931.

350,844. September 16th, 1930.—HIGH-SPEED SHAFT BEARINGS, *The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C. 2.*

This bearing is for high-speed shafts which require a copious supply of oil, not only for lubricating purposes, but also for cooling. The makers say that in such cases there is a liability for the oil to become frothy and to choke up the passages of the

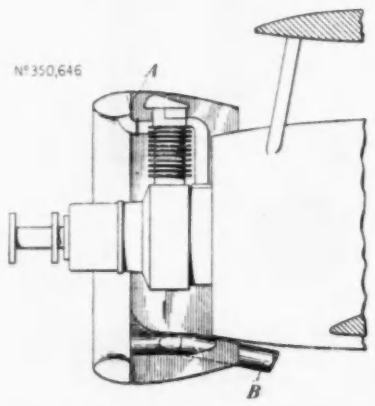


bearing pedestal. In order to overcome this trouble they supply the oil, under considerable pressure, by the pipe A, which is on the side of the bearing where the shaft is revolving upwards. A horizontal groove is cut in the bearing to distribute the oil, which passes over the top of the shaft in the cavity B to the groove C and is taken away by another pipe. The grooves D D are to prevent oil from spilling out at the ends of the bearing.—*June 18th*, 1931.

AERONAUTICS.

350,646. April 10th, 1930.—COWLINGS FOR AIR-COOLED INTERNAL COMBUSTION ENGINES, Boulton and Paul, Ltd., Norwich; and J. D. North, Hill House, Eaton Hill, Norwich.

This cowling serves the dual purpose of providing a strong draught of air for cooling the engine with a minimum head resistance, and of acting as an exhaust silencer. It is, it will be seen, of streamline form, like an aeroplane wing on the exterior.

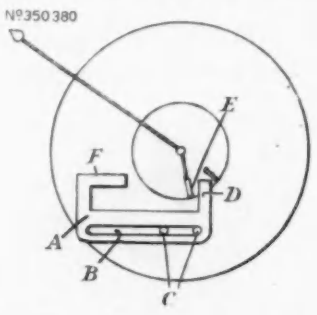


The opening for the passage of wind to the engine is less in diameter than the overall diameter of the cylinders. The inner wall of the cowling is turned back abruptly as shown at A to form a silencing chamber for the exhaust gases, which are discharged by two pipes B. It is stated that if the step A is at about one-fourth of the chord of the outer surface no appreciable effect on the streamline action of the cowling is produced.—*June 18th*, 1931.

MEASURING AND TESTING INSTRUMENTS.

350,380. February 1st, 1930.—ELECTRICAL MEASURING INSTRUMENTS, Ferranti, Ltd., of Hollinwood, Lancaster; and Edgar Harold Walter Banner, of the same address.

The drawing shows the invention applied to a moving iron

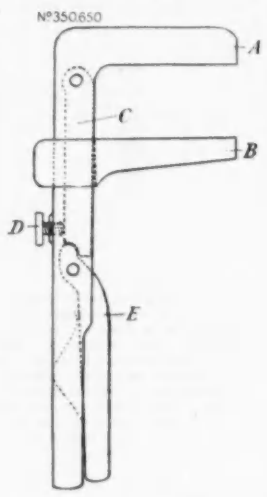


instrument of the repulsion type. An adjustable magnetic member A is mounted at one end of the energising coil bobbin and is capable of rectilinear movement within certain limits. The member is provided with a slot B engaging two fixed screws C secured to the coil bobbin flange. When the member is moved to one extreme limit of its travel one of its extremities D is, in a position adjacent the path of movement of the moving iron E, while, when the member is moved to the other extreme, the other extremity F occupies a somewhat similar position. Each extremity of the moving member exerts an attractive force upon the moving iron due to magnetism existing in the extremities of unlike polarity as compared with that in the moving iron, so that a position can be found in which the attractive force exerted upon the moving iron due to these extremities is equal, and in these circumstances the adjustable member A is non-effective in applying any modification of the normal action of the instrument. By moving the adjustable member to right or to left, however, the effective torque on the moving iron may be increased or decreased as desired, thus correspondingly increasing or reducing the scale readings obtained with a given return spring. Thus compensation for variation in strength of control spring, as compared with the standard spring, may readily be effected during testing of the instrument.—*June 1st*, 1931.

MACHINE TOOLS AND SHOP APPLIANCES.

350,650. April 14th, 1930.—AN ADJUSTABLE SPANNER, M. Shaw, c/o Dr. R. E. Hull, Fenham Carr, Lancaster.

The tool is a spanner with a fixed jaw A and an adjustable jaw B.

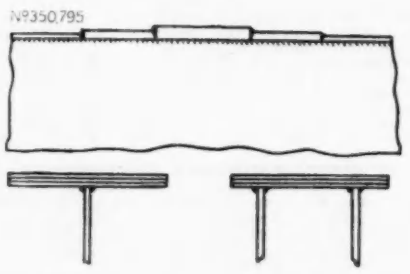


The loose jaw may be slid up the stem of the spanner to suit the size of the nut being turned, and is held in that position by serrations on the lever C, which is pressed into engagement either by the thumb screw D or by the lever E which is gripped by hand with the handle of the tool.—*June 18th*, 1931.

MISCELLANEOUS.

350,795. July 9th, 1930.—WELDED GIRDERS, Siemens-Schuckertwerke Aktiengesellschaft, Berlin-Siemensstadt, Germany.

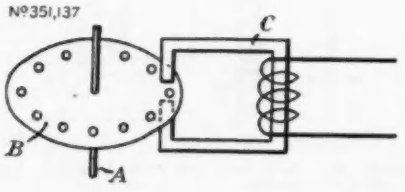
The essence of this invention appears to lie in the reinforcement of rolled steel joists by means of cover plates, which are



welded at their ends, where necessary, to the flanges of the joist and are also welded along the edges. It is not suggested as to whether the welding should be carried out by electrical or blow-pipe processes.—*June 18th*, 1931.

351,137. April 11th, 1930.—SYNCHRONISED MOTORS, Compagnie Pour la Fabrication des Compteurs et Matériel D'Usines, of 12, Place des Etats Unis, Montrouge (Seine), France.

The synchronising scheme described in this specification is applicable to television, &c. The simplest method of carrying out the invention consists in securing to the axle A of the motor a conducting disc B provided with a certain number of perforations depending upon the frequency of the synchronising current and upon the desired speed of the disc. The synchronising current is supplied to the windings of an electro-magnet C,



these windings being placed in fixed magnetic field, so as to produce an oscillating field through the disc. Since the solid sectors of the disc have less electrical resistance to eddy currents than the perforations, maximum braking occurs when the portion of the disc in front of the electro-magnet at the instant of maximum current is solid, and minimum braking when the portion of the disc is a perforation. It follows that the phase of rotation and that of the synchronising current have a connection which may be used for the stabilisation of the local motor.—*June 25th*, 1931.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

SATURDAY, JULY 25TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: NORTH-EASTERN DISTRICT.—Visit to Synthetic Ammonia and Nitrates, Ltd., Billingham. 11 a.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: SOUTH-EASTERN DISTRICT.—Meeting at Hastings. Assemble at Town Hall 11.30 a.m.

TUESDAY, JULY 28TH.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—Lecture Room at the School, Crystal Palace; 176th Award of Certificates. 3 p.m.

THURSDAY TO SATURDAY, SEPTEMBER 3RD TO 12TH.

"MODEL ENGINEER" EXHIBITION.—Royal Horticultural Hall, Westminster, S.W. 1. Daily.

SUNDAY TO SATURDAY, SEPTEMBER 6TH TO 12TH.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.—Congress at Zürich.

THURSDAY TO SATURDAY, SEPTEMBER 10TH TO 26TH.

SHIPPING, ENGINEERING AND MACHINERY EXHIBITION.—Olympia, W. Daily, 11 a.m. to 9 p.m.

SATURDAY TO WEDNESDAY, SEPTEMBER 12TH TO 16TH.

INTERNATIONAL FOUNDRY CONGRESS.—Milan.

SATURDAY TO SUNDAY, SEPTEMBER 12TH TO 27TH.

INTERNATIONAL FOUNDRY EXHIBITION.—At Milan.

SUNDAY TO FRIDAY, SEPTEMBER 13TH TO 18TH.

INSTITUTE OF METALS.—Autumn meeting at Zürich.

FRIDAY TO SUNDAY, SEPTEMBER 18TH TO 20TH.

NATIONAL SMOKE ABATEMENT SOCIETY.—Annual Conference at Liverpool.

TUESDAY TO FRIDAY, SEPTEMBER 29TH TO OCTOBER 2ND.

IRON AND STEEL INSTITUTE.—Autumn Meeting at Swansea.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

LORANCO, Ltd., of 65A, Fenchurch-street, London, E.C. 3, asks us to announce that Mr. H. H. Keal, A.M.I. Mech. E., has been appointed a director of the company.

H. WHITEHEAD AND CO., Sentinel House, Southampton-row, W.C. 1, has been appointed local agents for the following firms:—The Mansfield Engineering Company, Ltd., Hucknall, Notts.; The British Spun Glass and Insulating Company, Ltd., Leeds; and Grill Floors, Ltd., London.

BRAMPTON BROTHERS, Ltd., of Birch-road Works, Witton, Birmingham, ask us to announce that, consequent on agreements made with their associated companies, the following arrangements will be put into operation on and after August 1st, 1931:—(1) Brampton and Coventry chains have been interchangeable for several years past, and it is now proposed to concentrate the whole of the chain production under the Coventry mark; (2) Brampton fittings, pedals, hubs, &c., will continue to be manufactured under the Brampton mark, and (3) the selling and supply of all Brampton products will, in future, be undertaken by the Coventry Chain Company, Ltd., Spon End Works, Coventry.

CONTRACTS.

SIR WILLIAM ARROL AND CO., of Glasgow, have received from the Ministry of Transport an order for the dismantling of the three existing bridges and the erection of three new swing bridges operated by petrol-driven machinery at Fort Augustus, Aberchalder and Laggan, on the Caledonian Canal.

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., in conjunction with the Clyde Crane and Engineering Company, Ltd., has received the order for the whole of the electrically-operated winches for the Cunard vessel which is now under construction at John Brown and Co.'s yard at Clydebank.

THE ENGLISH ELECTRIC COMPANY, Ltd., of Stafford, has received from Dorman, Long and Co., Ltd.—who are contractors for the steel works and rolling mills—an order for the whole of the electrical equipment for the rolling mills which are being erected in the Pretoria district by the South African Iron and Steel Industrial Corporation. Particulars of this order, which approaches £150,000 in value, are given in another column in this issue.

UNIVERSITY COLLEGE AWARDS.—The following awards have been made at University College, London, in the Faculty of Engineering:—Goldsmid Entrance Scholarship, H. G. Lillicrap, Erith County School; L. F. Vernon-Harcourt Prize (Civil Engineering), R. Russell; Archibald P. Head Memorial Medal and Prize (Mechanical Engineering), E. A. S. Simonis; Chadwick Medal and Prize (Municipal Engineering and Municipal Hygiene), H. E. Stopher, subject to confirmation by the Chadwick Trustees.

INSTITUTION OF NAVAL ARCHITECTS' SCHOLARSHIPS.—The following scholarships have been awarded by the Council of the Institution of Naval Architects: Royal Commissioners for the 1851 Exhibition Post-graduate Research Scholarship in Naval Architecture (1931), £250 per annum for two years to Mr. William John Roberts, B.Eng., of Liverpool University; Sir William White Post-graduate Scholarship in Naval Architecture (1931), £150 per annum for two years, to Mr. J. A. J. Bennett, M.A., B.Sc., Ph.D., D.I.C., of Glasgow University.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The scrutineers appointed at the ordinary meeting held on April 30th, 1931, have reported to the President that the result of the ballot to fill the vacancies which will occur in the Council on September 30th next is as follows:—President, Captain J. M. Donaldson, M.C.; Vice-Presidents, Mr. J. M. Kennedy, Mr. F. W. Purse; Hon. Treasurer, Mr. E. Leete; Ordinary Members of Council: Members, Lieut.-Col. A. G. Lee, O.B.E., M.C., D.Sc., Mr. C. le Maistre, C.B.E., F.C.G.I., Mr. H. A. Ratcliff, Mr. E. H. Rayner, M.A., Sc.D.; Associate Members, Mr. R. H. Schofield, Mr. J. W. J. Townley; Companion, the Rt. Hon. the Viscount Falmouth.